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OCT/NOV 1983

SPECIAL FEATURE
Software checklist for the ZX81

ZX COMPUTING

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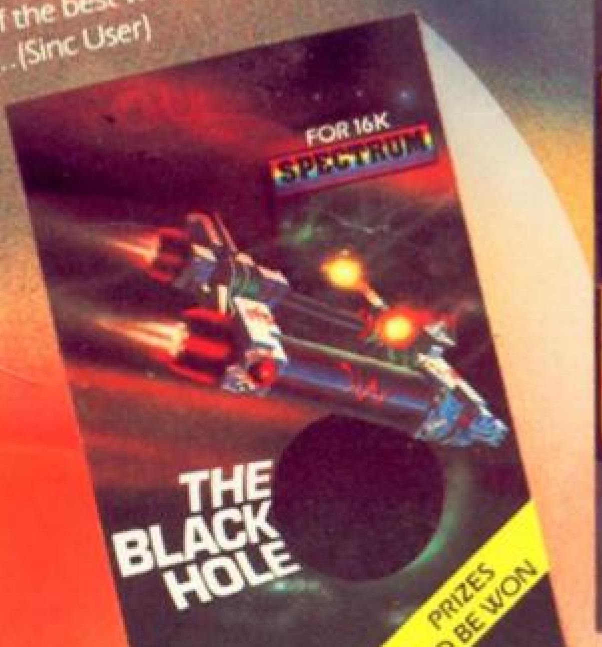
fantasy

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PARTICIPATION – that is the name of OUR game. All our software contains a unique score verification mechanism allowing us to add a new dimension to computer games. Every July and January we will be publishing a ranking list of the top 1000 scorers in each game with the overall top 100 'grand masters' each receiving certificates of merit bearing their position.

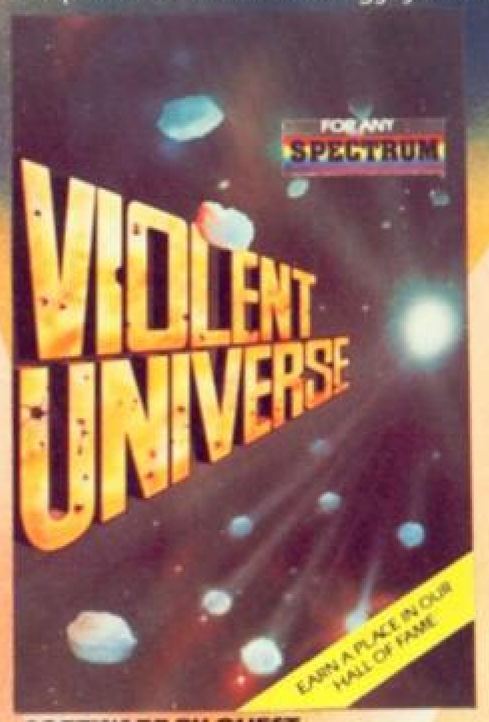
September is the last month to qualify for the Black Hole championship. However, from October the sender of the highest valid score each month will win software of their own choice to the value of £50.

The Black Hole is a technicoloured confection of special effects...very demanding; magnificent graphics. (Soft) The explosion effects are some of the best we have seen. ...(Sinc User)



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ZX COM

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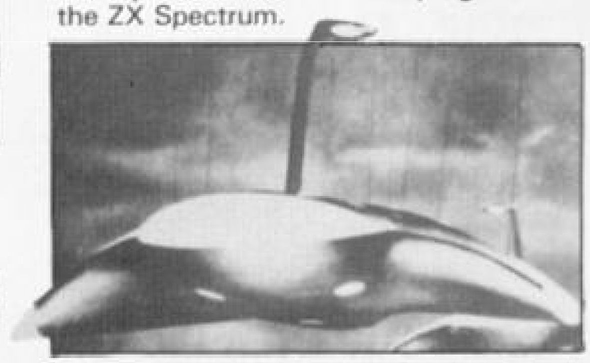
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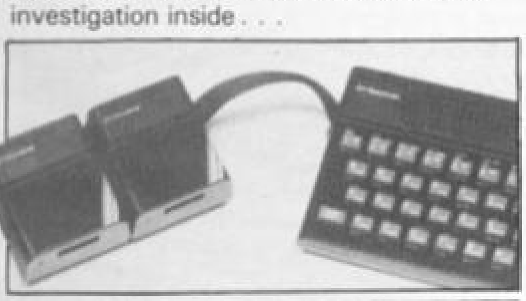
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MPUTING

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ZX Computing is constantly on the … **well-written articles and program**… **that your efforts meet our stand**… **free to submit your work to us** …
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THE ZX MICRODRIVE AND INTERFACE 1 DEVICES

For a full review turn to page 93

Welcome

Here we are again with another issue crammed full of great programs for your Sinclair micro, as well as all the news, views and reviews of all that's new over the last couple of months.

And speaking of news, did you hear about how Sir Clive got on in the Sinclair Cambridge Festival Half-Marathon. Sir Clive's time was one hour 47 minutes 43 seconds and he came in 949th out of a total of over 1,400 people who took part in the race. The winner, Bob Treadwell, completed the course in one hour four minutes 36 seconds.

Maybe it was just as well Sir Clive didn't arrive first through the tape after all, as the prizes included micros and software donated by Sinclair Research — and I should imagine that Sir Clive has more than enough Sinclair micros by now!



The big one . . .

Well, I'm sure you all know now that at last the Microdrives have been publicly announced and will soon start to grace Spectrum users' homes. Inside this issue you will find, not only the news of the press conference where it all happened but also a full report of its capabilities under test. For more details, see inside!

But that's not the only news from the commercial market — and if you want to get yourself up to date, check out the hardware and software news pages.

As far as software goes, James Walsh inspects another huge selection of Spectrum software and gives us his opinion on the latest releases. Nick Pearce also sifts through software for the ZX81 and you'll find his views in The '81 soft selection.

And if that wasn't enough, it seems that you feel very strongly about the software you buy — at least judging from the response to Reader's reviews, one of *ZX Computing's* new features. While it will be difficult to publish all of your reviews, it is great to get direct feedback from our readership on the software you buy, and I will certainly try and include as many of your reviews as possible in each issue.

Game for a laugh?

Amongst the great games programs you'll find in this issue, Spectrum golfer must surely stand out as a classic. Written for us by Ian Turtle, this 48K program for the ZX Spectrum is almost as good as the real thing! You get to choose your clubs, hit the ball with varying strengths and make those all-important putts — all on-screen. Ian has written the game so there are a large number of courses to battle your way around — I think you'll enjoy it a lot.

This program is supported by a whole host of terrific listings for 16/48K Spectrums — so no-one will really lose out.

For the ZX81, there is a wide selection of educational, utility, and business programs. Look out for Spider's web by Nicholas Wilding and a smashing racing car game from Steve Windsor called Grand prix driver — they're winners!

If you're a ZX80 owner, you're in for a real treat this issue. Mike Hyams has put together a 9K program called 3D maze which really pushes the ZX80 with added memory to its limits. A great program for the dedicated ZX80 enthusiast.

The best of the rest

If you've got any problems on your ZX micro, have a look at Problem page — if your particular problem isn't covered there, don't give up, just drop Peter Shaw a line and let him sort you out.

And if you want to sort your own problems out, then maybe the best way is to find a good book on computing and settle down to discovering more about this vast subject. To help you select the right volume, Patrick Cain, our regular bookworm, has chosen three titles to talk about this issue covering the subject of beginning computing on the Spectrum and ZX81, and how to make more of graphics on the ZX Spectrum.

Apologies to all you Toni Baker fans out there but I'm afraid we were not able to include an article from the lady herself this issue. Toni has been in and out of hospital for the last month or so and has been unable to get near a typewriter. Nevertheless, by the time you read this she will be up and about and ready to continue her Mastering machine code series and finish off the racing car program. Until then, I'm sure you'll join me in wishing her a speedy recovery.

Towards the back of this issue, you'll find an updated list of commercial ZX81 software along with a list of the suppliers. First featured in the April/May issue of *ZX Computing,* this new update includes many of the new titles released since then. Next month, we will be concentrating on software for the ZX Spectrum — so, if you've got a Spectrum and you're looking around for just the right software package, you've not got long to wait . . .

Contributions

We are always on the lookout for good programs and articles for future issues of *ZX Computing,* and where better to look than to our own readers. If, when reading through the magazine, you think you can write programs as well, or better than, our present contributors, then let's hear from you.

All contributions are, of course, paid for at very competitive rates. So if you've got your eye on a new ZX add-on or you'd just like to supplement your pocket money, get writing! It is vital, though, that all the programs you send us are totally original, and not 'borrowed' or 'adapted' from other magazines or books. (When Tim Hartnell was sitting in the Editor's chair, he even received 'original' contributions he himself had written for his own books!)

Any kind of program (business, domestic, educational, or just fun) will be welcomed, but particularly those which use ZX BASIC in clever and efficient ways, or those which employ certain routines which can be re-used on other programs.

Program listings are vital, along with a clear explanation of how the program is constructed, what it does and what the user can expect to see once the program is RUN (a screen dump is particularly valuable in this respect). When submitting Spectrum programs, it is very important to remember to enclose a cassette of the program as well as the listing, as this will allow us to check the program before publication.

They're off

Okay, you're on your own now — just you, your micro and *ZX Computing.* Make the most of them and I'll see you next issue with some special features specially geared towards the Christmas season.

Roger Munford.

Chip chat

Dear ZX Computing,
With reference to the letter from Quicksilva in the April/May issue of *ZX Computing*, Sound Advice, I think I can shed some light on the problems users have been experiencing with the Timegate program.

The spokesperson hit the nail on the head when he or she said that the 'crashing' does not occur on BASIC or small machine code programs.

A while ago I ordered a 32K expansion for my issue two Spectrum and I bought a Pascal compiler to make full use of my new 48K machine. Unfortunately, half way through compiling a program, it either crashed or just 'locked' the computer.

I ran a test machine code program to check the RAM and I found that the Spectrum was, in fact, having difficulty 'seeing' what was in extra RAM. The following test program should explain things better.



```
       LD HL,0000   ; Point to first location in memory
NEXT : LD A,(HL)    ; Get byte into accumulator
       CP (HL)      ; Compare with byte in memory
       LD B,H       ; Transfer to BC for return to BASIC
       LD C,L       ;
       RET NZ       ; If no match, return and report
       INC HL       ; Otherwise, bump pointer for next
       LD A,255     ;
       CP H         ;
       JR NZ,NEXT   ; End of memory?
       CP L         ;
       JR NZ,NEXT   ;
       LD B,H       ; Return to BASIC
       LD C,L       ;
       RET          ;
```

This program will, if your expansion 32K RAM is working correctly, report the number 65535, but otherwise will report a number between 32768 and 65535 inclusive showing that an error occured in fetching a byte from memory.

Of course, if you are running a BASIC program in this expansion RAM area, you will have no problems because of the slow speed and likewise, most machine code programs on sale now only need up to address 32767 to work. The problem arises when you try to run large machine code programs which do a lot of op-code fetching (typically all of them).

The fault then is in the type of chips you have in the expansion area. If you have an issue two Spectrum, which you can identify by blue keys and a couple of chips close to the expansion edge connector; the chips you should have are shown in Fig. 2.

Some manufacturers are supplying the 74 LS 158 with a pin missing and the memory chips as 3732 and these are the type I have been having trouble with. The spokesperson from Quicksilva suggests you send your Spectrum back to Sinclair but if you have fitted your own chips, they will charge you £30 for invalidation of warranty.

For less than £30 you can buy the right chips and fit them yourself. See Fig. 1 for a diagram of where to fit the chips — all the chips face with notches towards the edge connector.

I hope this letter has bought some enlightenment to other readers.
Yours faithfully,

Alan Turnbull,
Stockport.

74 LS 00	1 off	Four 2-input NAND gates
74 LS 32	1 off	Four 2-input OR gates
74 LS 157	1 off	Four 2-input data selectors
74 LS 158	1 off	As above, but output inverted
TMS 4532-20nL3	8 off	32K by one bit memory

Fig. 2. The chips you should have in your issue two ZX Spectrum.

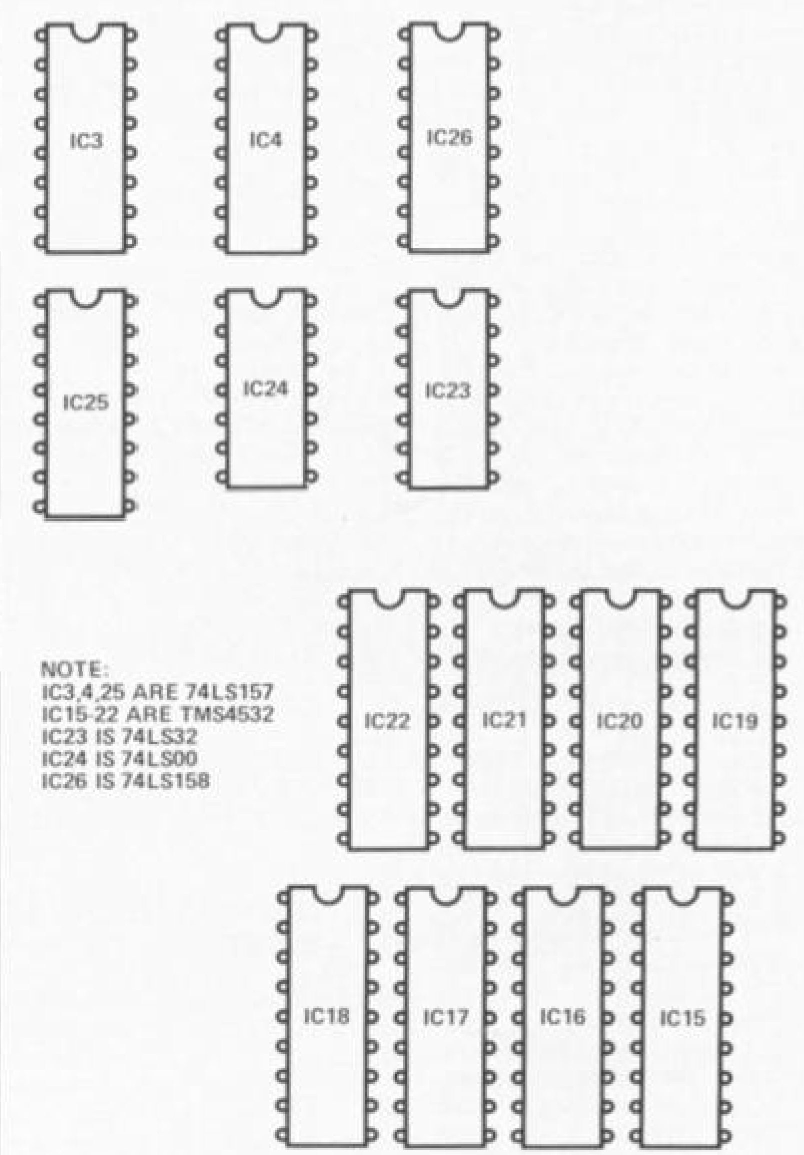


Fig. 1. A diagram to show you where to fit the necessary chips into your Spectrum.

Adding on

Dear ZX Computing,
After typing in the Sheepdog trial program in the April/May edition of *ZX Computing*, I wrote an addition to include a gate at the entrance to the pen. After three attempts, the routine was working sufficiently well to send to you. The additional lines are as follows:

```
765   IF INKEY$="W" THEN
      GOTO 3000
3000  REM * *GATE* *
3010  IF PEEK(W+313)=8
OR PEEK(W+313)=20 THEN
GOTO 720
3020  IF PEEK(W+313)=0
THEN GOTO 3060
3030  POKE W+313,0
3040  PAUSE 15
3050  GOTO 720
3060  POKE W+313,22
3070  PAUSE 15
3080  GOTO 720
```

The explanations are as follows:

765 Checks to see if 'W' was pressed (this can easily be altered).
3010 Checks to see if the gate square is occupied.
3020 Checks if the gate is there. If it is in place, it is removed by line 3030; if it is not there, it is put into position by line 3060.
3040/
3070 Are in place to allow time to remove the finger from the key (otherwise the gate is continually removed and replaced).

The routine was written without a GOSUB command in order to make it easier to go back to the INKEY$ in line 720 so that a move is not used up.
Yours faithfully,

Kevin Lownsborough,
Humberside.

An abbridged letter

Dear ZX Computing,
I was intrigued by R Wheen's problem of reading codes of the letters J, Q, K and A to correctly represent their values in a card game as outlined in his letter, Anyone for bridge?, featured in the April/May issue of *ZX Computing*.

Without knowing the structure of the program it is difficult to comment accurately, but I would have thought it unnecessary to resort to machine code. Suppose, for instance, that the cards are held in a string and as each trick is played the value of each card played is read into an array T(4). It is now a simple matter of converting the value of the 'picture' cards by reference to a short string P$.

Here is a listing of a short demonstration program. I would think the lines of interest to R Wheen are:

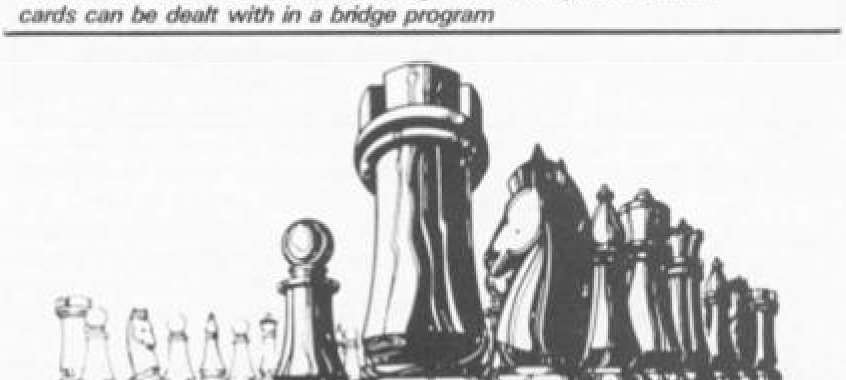
1) The declaration of P$ at line 30.
2) The double loop contained by lines 110 to 160.
3) Line 130 which does the test and converts the card value if required.

This also solves the supplementary question of a suitable letter to be used in place of 10 — anything will do, so long as it is entered in the correct position in P$ — I have used the letter 'T'.
Yours faithfully,

Ron Cavers,
Leicester.

```
  10 DIM T(4)
  20 LET C$="5K7J6T26A39Q4"
  30 LET P$="TJQKA"
  40 PRINT AT 0,0;"CARD"
  50 FOR F=1 TO 4
  60 LET R=INT (13*RND)+1
  70 LET T(F)=CODE C$(R)-26
  80 PRINT AT F*2,1;C$(R)
  90 NEXT F
 100 PRINT AT 0,5;"VALUE"
 110 FOR F=1 TO 4
 120 FOR G=1 TO 5
 130 IF CODE P$(G)-26=T(F) THEN
LET T(F)=9+G
 140 NEXT G
 150 PRINT AT F*2,7;T(F)
 160 NEXT F
 170 PAUSE 4E4
 175 IF INKEY$="C" THEN COPY
 180 CLS
 190 GO TO 40
```

Ron Cavers' short demonstration program showing how 'picture' cards can be dealt with in a bridge program



Check, mate

Dear ZX Computing,
I have now been a ZX81 owner for over a year. In this time, I have come across many problems in game making but the most frustrating problem I had was how to check whether, for example, I had crashed into a tree or some similar obstacle in a 'ski run' type program I was constructing.

I recently found out by research how the simplest way to do this was, and I thought it would be nice to share my newfound knowledge with the world!

Here is the short checking program:

```
10  LET A=CODE "(your
    symbol you want to check
    for, eg a car in graphics)"
15  PRINT AT X,Y;
20  IF(PEEK(PEEK 16398+
    256 * PEEK 16399))=
    A THEN STOP
```

The co-ordinates, x and y, in line 15 are the co-ordinates you want to check for your symbol. If, for example, you wanted to check the whole screen for a graphic square, you would use the following program:

```
10  FOR N=O TO 21
20  FOR M=O TO 31
30  PRINT AT N,M;
40  IF PEEK(PEEK 16398+
    256 * PEEK 16399)=
    128 THEN STOP
50  NEXT M
60  NEXT N
```

I hope ZX81 owners will find this useful.
Yours faithfully,

Matthew Guest,
South Yorkshire.



In the swim

Dear ZX Computing,
I write with regard to an article in your June/July 1983 edition in which you talk of the holidays organised by Dolphin Activities Ltd as being 'Dolphin Camps'. You will notice that Dolphin Activities Ltd do not use the term 'Dolphin Camps' because that name is applied to some camps which we have organised since 1919. The Dolphin Camps are canvas camps organised for preparatory school boys on the cliff top at West Runton, Norfolk. In addition, for older children, we organise specialist camps for go-karting, canoeing, sailing, etc.

You will apreciate that the similar names tend to cause some confusion which we are anxious to avoid.
Yours faithfully,

N Taylor,
33 Upper Walthamstow Road,
London E17.

The luck of the Irish

Dear ZX Computing,
ENTERing the program Leprechaun's gold from the June/July issue of *ZX Computing* as instructed presumably creates a special condition when lines 1 to 20 are ENTERed and RUN whereby it seems compulsory to ENTER the rest of the program, lines 190 to 9000, in one session and then SAVE it. This took me the best part of eight hours from 8pm one evening until around four o'clock in the morning, at which stage the program refused to LIST beyond line 6000! My 16K Spectrum had run out of memory.

This problem would have been avoided if the notes on ENTERing the program had commenced with the instruction to NEW after RUNning lines 1 to 20. This is because the Spectrum manual, page 147, makes it clear that the user-defined graphics will survive a NEW.

There is, however, an easier method of ENTERing a program of this length in several sessions, and this method follows.

1. Commence with lines 1 to 20, ENTERing them and SAVEing them on tape as a separate program, say under the title 'bytes'.
2. One may then ENTER lines 190 to 9000, stopping at any time and SAVEing the partially listed program when you want a break from the keyboard. Each time you wish to continue your task, the lines so far SAVEd may be LOADed and further lines added until the whole program has been ENTERed, and SAVEd on tape after the user-defined graphics program, lines 1 to 20. You could call this second program 'maze'.
3. It is now only necessary to LOAD "bytes", RUN, and then NEW, and then LOAD "maze".
4. At this stage, the special instructions in the notes to the program (as shown in the accompanying text to the program as published) for SAVEing, VERIFYing and LOADing may be followed.

And if that sounds complicated, believe me it beats a marathon session at the keyboard!

On the program itself, may I offer the following suggestions.

1. Line 7020 — If you amend the last instruction, GO TO 6015, to GO TO 6000, you are given the full introduction to the program between games. Useful I find where younger children are operating the machine.
2. The screen dumps conflict with the program listing in that the instructions state that capital letters in quotes are to be ENTERed in Graphics mode.

The screen dumps show the Green Goblin to be made up of:

Head — Letter mode 'o' (lower case)
Body — Letter mode 'O' (upper case)
Legs — UDG mode 'B'

whereas the program shows the Green Goblin to be made up of:

Head — Letter mode 'o' (lower case)
Body — UDG mode 'O'
Legs — UDG mode 'B'

This is satisfactory, and I have used the version as published, but the screen dumps also show the player to be made up of:

Head — Letter mode 'O' (upper case)
Body — UDG mode 'C'
Legs — UDG mode 'B'

whereas the program shows the player to be made up of:

Head — UDG mode 'O'
Body — UDG mode 'C'
Legs — UDG mode 'B'

This gives the player an odd-looking appearance as far as the head is concerned which is inconsistent with the player's appearance as you move forward. When you move the player forward, the head is Letter mode 'o' (lower case), which is fine because the player is diminishing in size. To be consistent with this when standing still — either prior to a move or when the gold has been found — the player should be made up of:

Head — Letter mode 'O' (upper case)
Body — UDG mode 'C'
Legs — UDG mode 'B'

I therefore suggest that when ENTERing line 4001, you make sure the 'O' part of the line is ENTERed in Letter mode rather than Graphics mode. Also, in line 7000, the part of the listing which reads:

...AT w+s,m-t; INK a; "O"; AT w...

should containt the 'O' ENTERed in Letter rather than Graphics mode.

Hope this proves interesting to other readers.
Yours faithfully,

Alan Mahon,
Tallaght,
Ireland.

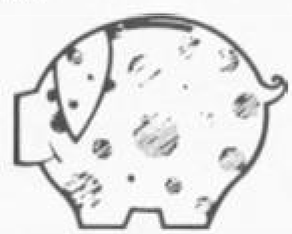
In short...

Dear ZX Computing,
This may be the shorter window-inverting program that John Scholfield was seeking in his letter in the June/July issue of *ZX Computing*, A touch of genius. Here is my program:

```
2A OE 40    Start line zero,
            column zero
11(88)00
19          GOTO line four,
            column four
06(OE)
OE(18)
7E
C6 80       Invert 24
            characters
77
23
OD
20 F8
11 09 00
19          GOTO next line,
            column four
10 FO       Repeat to 14 lines
CG          End
```

Hope this is useful to your readers.
Yours faithfully,

G Jackson,
Cardiff.



Who wants to be a millionaire?

I write with regard to your letter in the Dec/Jan issue of *ZX Computing*, The 10,000th prime.

At the time I had recently bought a ZX Spectrum and decided that prime number investigation would be a good way to learn how to use it. I write a BASIC program which took eight hours to calculate the 10,000th prime. Embarking on machine code, I wrote a similar program using division to test primes. This took just under four minutes to find the 10,000th prime.

I extended the program and it took just over three days to find the millionth prime.

Now comes the interesting bit. The ancient Greek, Eratosthenes, invented a method for finding prime numbers which he called The Sieve. He wrote down all numbers, then crossed out all even numbers after 2, every third number after three and so on. This leaves the prime numbers. A machine code program based on The Sieve took six seconds to find the 10,000th prime and 30 minutes to find the millionth. For interested parties, the value is 15,485,857 (calling one the first prime). Can anybody beat that?
Yours faithfully,

D Gold,
London N12.

Even stranger...

Dear ZX Computing,
With regard to Toby Philpott's letter, Strange (as published in the June/July issue of *ZX Computing)*, on RAND USR statements, here are two such statements of mine, for use on the ZX81 with 16K RAM.

Type in the following:

```
1 RAND USR IIIII
2 RAND USR IIIOO
RUN
```

The first statement shows the two line program repeated three times within the contents of RAM. It's the equivalent of PEEKing locations 16510 onwards.

Then type in:

```
RUN 2
```

This PEEKs into the first 330 contents of ROM.
Yours faithfully,

Al Villacci,
Hove.

Clubbed corner

Dear ZX Computing,
I write with reference to a letter published in the June/July of *ZX Computing* in the Club corner section of the magazine.

It must be stated that our club, Hobby Computer Club, has nothing to do with Club Micro Europe which is a private organisation. We are a non-profit organisation and are state controlled.

ZX users wishing to contact our club may do so at the address given below. The Sinclair User Group is known under the name, BUGS, which stands for Belgium User Groups for Sinclair computers — a part of the HCC.
Your faithfully,

Mr Op de Beeck,
Patrick Drabstraat 40,
2510 Mortsel,
Belgium.
Telephone: 03-449-4445 (after 7pm)

Too many variables

Dear ZX Computing,
Experimenting with the system variables on my 16K Spectrum, I discovered a POKE to instantly fill the screen with vertical lines, without crashing. The lines are in the present INK colour, and could be useful, you never know when you might need it.

Here it is:

```
POKE 23659,1
```

This POKE is to the DF SZ part of the system variables, and it works because it is to do with how many lines there are in the lower part of the screen. This number is usually two, so POKEing in one stretches the upper part of the screen down leaving vertical lines.

Also, I found that if you POKE, say, zero into address 23614, and make an error so the syntax marker appears, your program NEWs. This POKE is very unuseful but it is a good thing to do if people who say they know everything have a go on your Spectrum.
Yours faithfully,

N M Durant,
Selby.

What's on the radio?

Dear ZX Computing,
You seem to be receiving so many LOAD/SAVE hints of late that I felt I must give you one which I found very useful.

If you are using a radio/cassette recorder in conjunction with your micro, you may find your programs (the ones you have SAVEd using this arrangement) are absolutely littered with clicks and buzzes, and rarely LOAD successfully. This is because the radio/cassette's radio often remains very slightly operative while the tape part of the unit is being used. This means that the radio is picking up signals from both TV and micro, and is sending them to your tape while you are SAVEing a program.

There are two ways to prevent this. Firstly, you can switch the television off whilst you are SAVEing and secondly, you can move the recorder as far from the micro as your leads will allow or hide the recorder (particularly its aerial) behind or under books or whatever is handiest. It would also be a good idea if you switch off any nearby electrical influences, such as vacuum cleaners, etc.

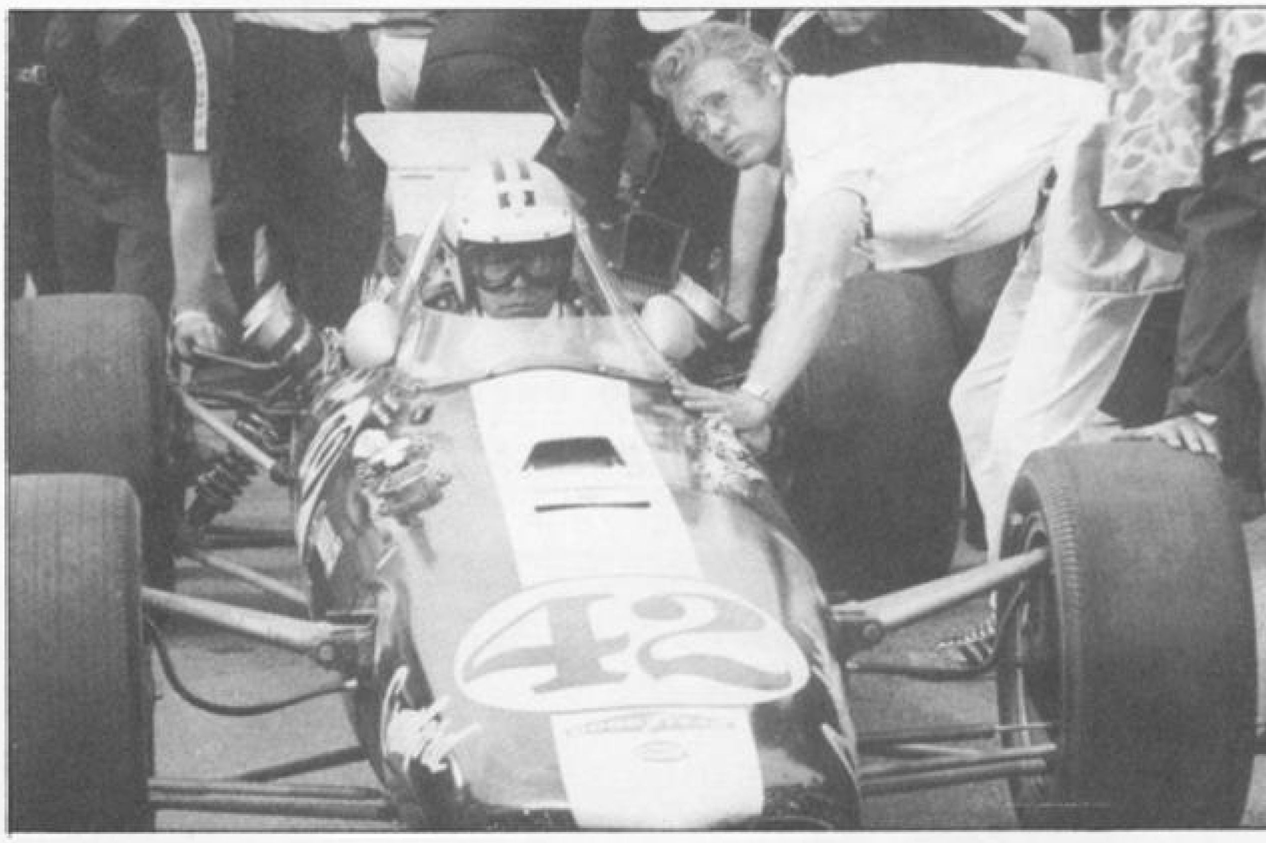
You could always borrow a friend's cassette recorder and check whether is the radio part of your machine which is causing the problem. In my experience, particular brands of radio/cassette machine do cause problems to programmers — and they are not always the cheap varieties!
Yours faithfully,

Aonghus de Barra,
Dublin.

Grand prix driver

This program, occupying almost 15K, simulates a 10 lap race around a Grand Prix circuit involving all the thrills and spills of the real thing!

Racing around the track clockwise, you move your car using the '5' key to move to the left, the '8' key to move right, the '7' key to move up and the '6' key to move down.



Strap yourself in and prepare yourself for the race of your life with this ZX81 program from Steve Windsor of Surrey.

A grand time

You'll have to watch out for various obstacles on the track, because if you hit them they will cause you to incur time penalties. If you accidently hit the outer barrier of the track, your car will crash and you are out of the race instantly. Also, if you have an accident in the pits, it is supposed your car will be blown to pieces. Should you crash into the inner barrier, your car will automatically be towed to the pits where it will undergo extensive repairs which will cause you to lose a lap. However, if you manage to crash your car into the barrier again, your car will burst into flames and you are placed out of the race for good!

You begin the race with a full tank of petrol — 800 litres — which should be enough for about seven to eight laps if you drive carefully. After you have completed seven laps you may enter the pits and be re-fuelled with 50 litres of petrol. You can drive through the pits before this stage of the race, but you will not receive any extra fuel.

When you drive into the pits you must take care as there is usually a lot of oil carelessly strewn around which makes skidding very easy to do.

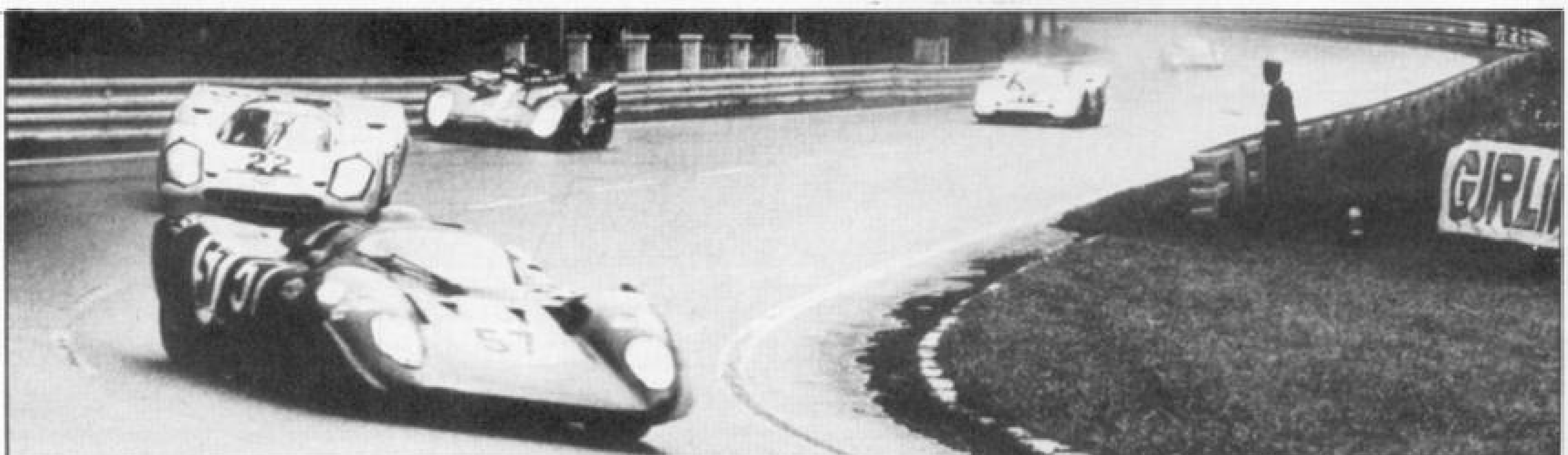
No cheating . . .

Various routines have been put in making it very hard for you to cheat in this game. You are not allowed to drive through the pits backwards thus re-fuelling more than once a lap, and you may not drive backwards and forwards across the start/finish line.

Various indicators, such as 'fuel remaining' and 'lap number', are displayed and updated each time you cross the start/finish line (or when you crash) giving you some idea of your progress throughout the game.

```
   1 REM "GRAND PRIX DRIVER"
   2 REM BY A D, S L AND R G
          WINDER
  10 REM LIST OF MAIN FEATURES
 100 REM GAME START/SET-UP
         200-299
 105 REM PLAYING INSTRUCTIONS
         300-799
 110 REM PARAMETER SETTING
         3250-3299
 120 REM MAIN DISPLAY 4000-4220
 130 REM VARIABLE RESETTING
         800-849
 140 REM MAIN LOOP 850-1190
 143 REM LAP COUNTER
         2800-2830
 147 REM REFUELLING 3500-3599
 150 REM *MAJOR CRASH ROUTINES*
 152 REM  1500-1515
          (OUTER CRASH BARRIER)
 154 REM  1950-1999
          (ACCIDENT IN PITS)
 156 REM  1200-1249
          (FUEL TANK EXPLOSION)
 160 REM *VARIOUS MINOR CRASH
          SUB-ROUTINES*
 161 REM  1600-1649
          (INNER CRASH BARRIER)
 163 REM  1650-1699
          (START AND FINISH
           LINE BEND)
 164 REM  1700-1749
          (SECOND BEND)
 166 REM  1750-1799 (CHICANE)
 167 REM  1800-1849
          (WAZZERS CURVE)
 168 REM  1850-1899
          (END OF STRAIGHT)
 170 REM VARIOUS INVOLUNTARY
```

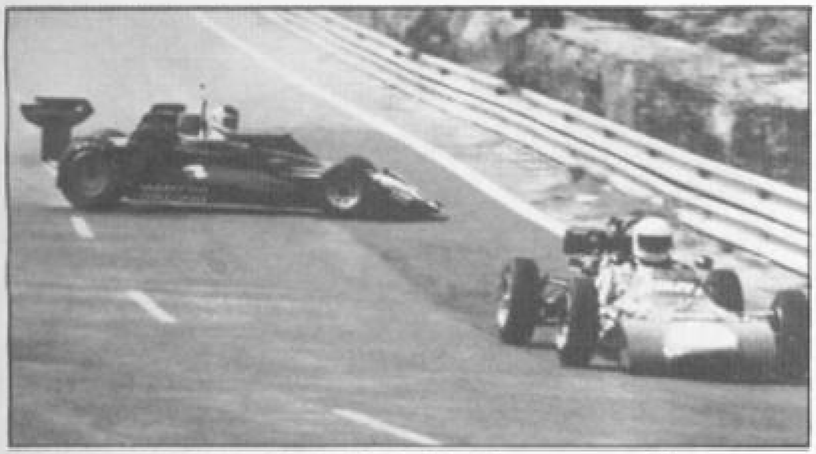
```
        SKID ROUTINES 1130-1189
 175 REM FUEL EXHAUSTION ROUTINE
        1191-1199
 180 REM NEW LEADER 2500-2799
 185 REM *YOU HAVE WON* ROUTINE
        2000-2499
 190 REM *ANOTHER GAME* ROUTINE
        1533-1575
 200 GOSUB 3250
 210 CLS
 220 PRINT AT 10,5;"PLEASE ENTER
 YOUR NAME"
 226 PRINT AT 15,6;"THEN PRESS "
"NEW LINE"""
 230 INPUT Y$
 231 CLS
 232 PRINT AT 6,6;"DO YOU REQUIR
E"
 233 PRINT AT 10,5;"PLAYING INST
RUCTIONS?"
 234 INPUT N$
 235 IF N$="YES" THEN GOTO 300
 245 CLS
 250 PRINT AT 12,4;"PRESS ANY KE
Y TO PLAY"
 260 PAUSE 4E4
 270 CLS
 280 LET S=0
 290 LET X=0
 298 GOSUB 4000
 299 GOTO 800
 300 CLS
 310 PRINT AT 1,6;"""GRAND PRIX
DRIVER"""
 320 PRINT AT 2,6;"*************
*****"
 370 PRINT AT 4,0;"THE OBJECT OF
 THE GAME IS TO      DRIVE YOUR CA
R AROUND THE TRACK,UNTIL YOU HAV
E COMPLETED THE      FULL RACE DIS
TANCE, WHICH IS 10 LAPS OF THE C
IRCUIT.      "
 380 PRINT AT 10,0;"THE ""START
+ FINISH POINT"" IS      SITUATED A
T THE BOTTOM CENTRE OFTHE TRACK
AND YOU SHOULD PROCEEDCLOCKWISE.
"
 400 PRINT AT 15,0;"IN ORDER TO
MOVE YOUR CAR        - TO THE LEF
T, PRESS KEY ""5""      - TO THE R
IGHT, PRESS KEY ""8""    - UP THE
SCREEN, PRESS KEY ""7""   - DOWN
 THE SCREEN, PRESS KEY ""6"""
 410 PRINT AT 21,2;"PRESS ANY KE
Y TO CONTINUE >>>>"
 420 PAUSE 4E4
 430 CLS
 440 PRINT AT 0,0;"IF YOU HIT AN
Y OF THE OBSTACLES,YOU WILL BE P
ENALISED, USUALLY   BY LOSS OF TI
ME.  HOWEVER, HIT- TING THE OUTE
R BARRIER WILL PUT YOU OUT OF TH
E RACE IMMEDIATELY AND AN ACCIDE
NT IN THE PITS WILLBLOW YOU TO S
MITHEREENS."
```



```
 450 PRINT AT 8,0;"COLLIDING WIT
H THE INNER CRASH   BARRIER CAUSE
S FAIRLY EXTENSIVE DAMAGE, REQUI
RING A PIT STOP -   YOUR CAR WILL
 BE TOWED THERE     AUTOMATICALLY
 AND YOU WILL LOSE ONE COMPLETE
LAP."
 455 PRINT AT 15,0;"HITTING THE
INNER CRASH BARRIER BEFORE YOU H
AVE COMPLETED 1 FULLLAP (OR MORE
 THAN ONCE) WILL SETYOUR CAR ON
FIRE AND PUT YOU OUTOF THE RACE
PERMANENTLY."
 460 PRINT AT 21,2;"PRESS ANY KE
Y TO CONTINUE >>>>"
 470 PAUSE 4E4
 480 CLS
 540 PRINT AT 1,0;"YOU START THE
 RACE WITH A FULL   TANK OF FUEL
 ( 800 LITRES ) AND,AFTER COMPLET
ING 7 FULL LAPS,    YOU MAY REFUE
L SIMPLY BY DRIVINGINTO THE PITS
.  BEFORE THIS, YOUCAN DRIVE THR
OUGH THE PITS IF    YOU WISH, BUT
 WILL RECEIVE NO    ADDITIONAL FU
EL."
 550 PRINT AT 10,0;"YOU WILL REC
EIVE ONLY AN ADDIT- IONAL 50 LIT
RES ON EACH REFUELL-ING STOP."
 560 PRINT AT 14,0;"WAIT UNTIL R
EFUELLING HAS BEEN  COMPLETED BE
FORE ATTEMPTING TO  DRIVE ON."
 570 PRINT AT 18,0;"BEWARE OF SK
IDDING ON THE PIT   ROAD, WHICH
IS COVERED IN OIL."
 580 PRINT AT 21,2;"PRESS ANY KE
Y TO CONTINUE >>>>"
 590 PAUSE 4E4
 600 CLS
 603 PRINT AT 0,0;"THERE ARE OTH
ER HAZARDS AND THE ROAD SURFACE
IS VERY SLIPPERY INPLACES - YOU
WILL NEED TO DRIVE CAREFULLY."
 605 PRINT AT 5,0;"YOU ARE NOT A
LLOWED TO DRIVE     BACKWARDS THR
OUGH THE PITS, NOR THROUGH THE S
TART + FINISH LINE."
 610 PRINT AT 9,0;"ON LEAVING TH
E PITS, YOU MAY NOTTURN RIGHT (U
P THE SCREEN) AND   YOU CANNOT, T
HEREFORE, REFUEL    MORE THAN ONC
E ON THE SAME LAP."
 620 PRINT AT 14,0;"THE ""FUEL R
EMAINING"" AND ""LAP    NO"" DISP
LAYS WILL ONLY UPDATE    AS YOU P
ASS THE START + FINISH   POINT (D
ISPLAYED IN WHITE) OR    IF YOU S
HOULD HAVE AN ACCIDENT."
 630 PRINT AT 20,2;"NOW PRESS AN
Y KEY TO PLAY"
 640 PRINT AT 21,3;"**** HAPPY D
RIVING ****"
 790 PAUSE 4E4
 799 GOTO 270
 800 LET Z=13
```

```
810 LET A=16
850 LET X=X+1
870 IF A=2 AND Z=24 THEN LET A=A+1
880 IF A=2 AND Z=25 THEN LET A=A+1
900 IF A=15 AND Z=13 THEN LET A=A+1
920 IF A=1 AND Z=26 THEN GOSUB 3500
930 IF A=1 AND Z=27 THEN LET Z=Z+1
940 IF A=14 AND Z=13 THEN GOTO 2800
950 IF INKEY$="5" THEN LET Z=Z-1
960 IF INKEY$="7" THEN LET A=A-1
970 IF INKEY$="6" THEN LET A=A+1
980 IF INKEY$="8" THEN LET Z=Z+1
990 PRINT AT A,Z;"■";AT A,Z;"▒"
1000 IF A=0 THEN GOTO 1500
1010 IF A=19 THEN GOTO 1500
1020 IF Z=0 THEN GOTO 1500
1030 IF Z=31 THEN GOTO 1500
1035 IF A=2 AND Z>25 AND Z<30 THEN GOTO 1950
1040 IF A>6 AND A<13 AND Z>6 AND Z<25 THEN GOSUB 1600
1050 IF A>12 AND A<16 AND Z=12 THEN GOSUB 1650
1060 IF A>14 AND Z=14 THEN GOSUB 1650
1070 IF A=8 AND Z>3 AND Z<7 THEN GOSUB 1700
1080 IF A=11 AND Z<5 THEN GOSUB 1700
1090 IF A=4 AND Z>25 THEN GOSUB 1750
1100 IF A=10 AND Z>26 THEN GOSUB 1750
1110 IF A=7 AND Z>23 AND Z<28 THEN GOSUB 1750
1120 IF Z=10 AND A<5 THEN GOSUB 1800
1125 IF Z=23 AND A>2 AND A<7 THEN GOSUB 1850
1130 IF A=17 AND Z=5 THEN LET Z=2
1135 IF A=16 AND Z=3 THEN LET Z=1
1140 IF A=5 AND Z=1 THEN LET A=2
1145 IF A=4 AND Z=2 THEN LET A=2
1150 IF A=4 AND Z=3 THEN LET A=1
1155 IF A=4 AND Z=11 THEN LET A=1
1158 IF A=3 AND Z=21 THEN LET A=5
1160 IF A=6 AND Z=19 THEN LET Z=21
1165 IF A=5 AND Z=20 THEN LET Z=22
1170 IF A=14 AND Z=28 THEN LET A=17
1175 IF A=15 AND Z=27 THEN LET A=17
1180 IF A=15 AND Z=26 THEN LET A=17
1185 IF A=15 AND Z=17 THEN LET A=17
1190 IF X<600 THEN GOTO 850
1191 FOR Y=0 TO 10
1192 PRINT AT 8,8;"  YOU HAVE RUN    "
1193 PRINT AT 9,8;"   OUT OF FUEL   "
1194 NEXT Y
1195 PAUSE 250
1197 PRINT AT 10,8;"[illegible]"
1198 PRINT AT 11,8;"[illegible]"
1199 GOTO 1516
1200 FOR L=0 TO 10
1210 PRINT AT 11,8;"                    "
1215 PRINT AT 11,12;"WHOOMPH"
1220 NEXT L
1225 PAUSE 150
1230 PRINT AT 11,8;"[illegible]"
1235 PRINT AT 7,8;"[illegible]"
1240 PRINT AT 8,6;"[illegible]"
1245 PRINT AT 9,8;"[illegible]"
1249 GOTO 1195
1500 FOR J=0 TO 10
1502 PRINT AT 11,8;"                    "
1504 PRINT AT 11,12;"CRAAASH"
1506 NEXT J
1507 PAUSE 150
1508 PRINT AT 11,8;"[illegible]"
1510 PRINT AT 6,6;"[illegible]"
1512 PRINT AT 9,8;"[illegible]"
1514 PRINT AT 10,8;"[illegible]"
1515 PRINT AT 11,8;"[illegible]"
1516 PAUSE 250
1520 CLS
1523 IF S>E THEN GOTO 2500
1524 FOR Q=0 TO 10
1525 PRINT AT 5,3;"                              "
1526 PRINT AT 8,9;"                    "
1527 PRINT AT 5,3;"THE CURRENT RACE LEADER IS"
1528 PRINT AT 8,9;B$;" ( ";E;" LAPS)"
1532 NEXT Q
1533 PAUSE 150
1535 CLS
1536 PRINT AT 14,8;"ANOTHER GAME ?"
1540 INPUT M$
1542 IF M$="YES" THEN GOTO 210
1544 IF M$="NO" THEN GOTO 1560
1550 PRINT AT 14,0;"U MAY ONLY ANSWER ""YES"" OR ""NO"""
1552 PAUSE 150
1556 GOTO 1535
1560 CLS
1563 PRINT AT 12,2;"OK. HOPE YOU ENJOYED PLAYING"
1566 PRINT AT 14,7;"""GRAND PRIX DRIVER"""
1570 PRINT AT 18,9;"BYE BYE FOR NOW"
1575 STOP
1600 LET S=S-1
1605 IF S<0 THEN GOTO 1200
1610 FOR R=0 TO 10
1611 PRINT AT 11,8;"                    "
1613 PRINT AT 11,12;"GRAUNCH"
1615 NEXT R
1617 PAUSE 150
1620 PRINT AT 11,8;"[illegible]"
1622 PRINT AT 7,8;"[illegible]"
1624 PRINT AT 8,6;"[illegible]"
1626 PRINT AT 9,7;"[illegible]"
1628 PRINT AT 10,8;"[illegible]"
1630 PAUSE 100
1632 PRINT AT 11,7;"[illegible]"
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1635 PRINT AT 12,12;"ONE LAP"
1640 PAUSE 250
1643 GOSUB 4000
1646 LET A=1
1647 LET Z=30
1648 PRINT AT A,Z;"▧";AT A,Z;"▒"
1649 RETURN
1650 FOR T=0 TO 10
1652 PRINT AT 11,8;"                 "
1654 PRINT AT 11,12;"ZEEURCH"
1656 NEXT T
1657 PAUSE 150
1658 PRINT AT 11,8;"                 "
1660 PRINT AT 7,1;"               YOU HAVE SPUN AT               "
1662 PRINT AT 8,1;"               THE START AND               "
1663 PRINT AT 9,1;"          FINISH LINE BEND AND          "
1664 PRINT AT 10,1;"MUST AWAIT A GAP IN THE FIELD"
1666 PRINT AT 11,1;"BEFORE RETURNING TO THE TRACK"
1668 PAUSE 250
1669 PRINT AT 12,1;"                              "
1670 PRINT AT 13,1;"THIS WILL COST YOU 40 SECONDS"
1675 LET X=X+40
1676 LET A=16
1678 LET Z=13
1680 PAUSE 250
1690 GOSUB 4000
1695 PRINT AT A,Z;"▧";AT A,Z;"▒"
1699 RETURN
1700 FOR W=0 TO 10
1702 PRINT AT 11,8;"                 "
1704 PRINT AT 11,11;"SCREEEECH"
1706 NEXT W
1707 PAUSE 150
1709 PRINT AT 11,8;"                 "
1710 PRINT AT 7,8;"YOU HAVE SKIDDED"
1712 PRINT AT 8,8;"  AT THE SECOND   "
1713 PRINT AT 9,8;"         BEND         "
1714 PAUSE 100
1715 PRINT AT 11,7;"THIS WILL COST YOU"
1716 PRINT AT 12,8;"    20 SECONDS    "
1720 PAUSE 250
1722 LET A=11
1724 LET Z=5
1725 LET X=X+20
1730 GOSUB 4000
1740 PRINT AT A,Z;"▧";AT A,Z;"▒"
1749 RETURN
1750 FOR K=0 TO 10
1752 PRINT AT 11,8;"                 "
1754 PRINT AT 11,12;"CRUUNCH"
1756 NEXT K
1758 PRINT AT 11,8;"                 "
1760 PRINT AT 8,8;"YOU HAVE CLIPPED  "
1762 PRINT AT 9,10;"THE CHICHANE"
1764 PAUSE 100
1765 PRINT AT 10,7;"THIS WILL COST YOU"
1766 PRINT AT 11,8;"    10 SECONDS    "
1772 LET Z=25
1774 LET A=3
1775 LET X=X+10
1780 PAUSE 250
1790 GOSUB 4000
1795 PRINT AT A,Z;"▧";AT A,Z;"▒"
1799 RETURN
1800 FOR B=0 TO 10
1802 PRINT AT 11,8;"                 "
1804 PRINT AT 11,11;"SSSPAANGG"
1806 NEXT B
1808 PRINT AT 11,8;"                 "
1810 PRINT AT 7,8;"YOU HAVE BRAKED  "
1811 PRINT AT 8,8;"  TOO LATE AT     "
1812 PRINT AT 9,8;" JAZZERS CURVE  "
1814 PAUSE 100
1815 PRINT AT 11,7;"THIS WILL COST YOU"
1816 PRINT AT 12,8;"    40 SECONDS    "
1822 LET Z=8
1824 LET A=5
1825 LET X=X+40
1830 PAUSE 250
1840 GOSUB 4000
1845 PRINT AT A,Z;"▧";AT A,Z;"▒"
1849 RETURN
1850 FOR U=0 TO 10
1852 PRINT AT 11,8;"                 "
1854 PRINT AT 11,12;"SMAAASH"
1856 NEXT U
1857 PAUSE 150
1858 PRINT AT 11,8;"                 "
1860 PRINT AT 7,8;"YOU HAVE SMASHED"
1862 PRINT AT 8,8;" INTO THE STRAW   "
1863 PRINT AT 9,8;"BALES AT THE END"
1864 PRINT AT 10,8;" OF THE STRAIGHT. "
1866 PAUSE 250
1867 PRINT AT 11,7;"THIS WILL COST YOU"
1868 PRINT AT 12,8;"    60 SECONDS    "
1869 PAUSE 250
1871 LET X=X+60
1872 LET A=2
1873 LET Z=21
1874 GOSUB 4000
1875 PRINT AT A,Z;"▧";AT A,Z;"▒"
1899 RETURN
1950 FOR V=0 TO 10
1955 PRINT AT 11,8;"                 "
1960 PRINT AT 11,8;"   - KABOOOM -   "
1965 NEXT V
1970 PAUSE 150
1978 PRINT AT 11,8;"                 "
1982 PRINT AT 7,8;"YOU HAVE CRASHED"
1985 PRINT AT 8,8;"IN THE PIT LANE"
1990 PRINT AT 9,7;"BLOWN YOURSELF TO"
1995 PRINT AT 10,8;"        BITS        "
1999 GOTO 1516
2000 FOR D=1 TO 10
2010 PRINT AT 11,18;"     "
2020 PRINT AT 11,19;S
2030 NEXT D
2040 PAUSE 250
2050 CLS
2100 FOR G=0 TO 53
2103 PRINT "YOU HAVE WON ";
2106 NEXT G
2110 FOR H=0 TO 10
2113 PRINT AT 1,2;" ▪  ▪ "
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2116 PRINT AT 17,2;" [illegible] "
2120 PRINT AT 2,2;" [illegible] "
2123 PRINT AT 18,2;" [illegible] "
2126 PRINT AT 3,2;" [illegible] "
2130 PRINT AT 19,2;" [illegible] "
2133 PRINT AT 4,2;" [illegible] "
2136 PRINT AT 20,2;" [illegible] "
2140 PRINT AT 5,2;" [illegible] "
2143 PRINT AT 21,2;" [illegible] "
2150 PRINT AT 1,24;" [illegible] "
2160 PRINT AT 17,24;" [illegible] "
2170 PRINT AT 2,24;" [illegible] "
2180 PRINT AT 18,24;" [illegible] "
2190 PRINT AT 3,24;" [illegible] "
2200 PRINT AT 19,24;" [illegible] "
2210 PRINT AT 4,24;" [illegible] "
2220 PRINT AT 20,24;" [illegible] "
2230 PRINT AT 5,24;" [illegible] "
2240 PRINT AT 21,24;" [illegible] "
2251 PRINT AT 1,2;" [illegible] "
2261 PRINT AT 17,2;" [illegible] "
2271 PRINT AT 2,2;" [illegible] "
2281 PRINT AT 18,2;" [illegible] "
2291 PRINT AT 3,2;" [illegible] "
2301 PRINT AT 19,2;" [illegible] "
2311 PRINT AT 4,2;" [illegible] "
2321 PRINT AT 20,2;" [illegible] "
2331 PRINT AT 5,2;" [illegible] "
2341 PRINT AT 21,2;" [illegible] "
2350 PRINT AT 1,24;" [illegible] "
2360 PRINT AT 17,24;" [illegible] "
2370 PRINT AT 2,24;" [illegible] "
2380 PRINT AT 18,24;" [illegible] "
2390 PRINT AT 3,24;" [illegible] "
2400 PRINT AT 19,24;" [illegible] "
2410 PRINT AT 4,24;" [illegible] "
2420 PRINT AT 20,24;" [illegible] "
2430 PRINT AT 5,24;" [illegible] "
2440 PRINT AT 21,24;" [illegible] "
2450 NEXT H
2460 GOSUB 3250
2470 LET G$="NO ONE"
2499 GOTO 1533
2500 CLS
2510 LET F=E
2520 LET E=S
2530 LET G$=B$
2540 LET B$=Y$
2550 CLS
2560 FOR C=0 TO 20
2570 PRINT AT C,0;"[illegible]"
2580 NEXT C
2650 FOR P=0 TO 4
2660 PRINT AT 5,11;"[illegible]"
2670 PRINT AT 6,4;"[illegible]"
2680 PRINT AT 7,9;"[illegible]"
2690 PRINT AT 9,13;"[illegible]"
2700 PRINT AT 12,5;"[illegible]"
2710 PRINT AT 14,13;"[illegible]"
2720 PRINT AT 17,2;"
"
2730 PRINT AT 18,2;"
"
2740 PRINT AT 19,2;"
"
2745 PRINT AT 5,11;"[illegible]"
2750 PRINT AT 6,4;"[illegible] KEN THE LEAD"
2755 PRINT AT 7,9;"[illegible] NG."
2760 PRINT AT 9,13;E;"[illegible]"
2765 PRINT AT 12,5;"[illegible] LEADER IS"
2770 PRINT AT 14,13;B$
2775 PRINT AT 17,3;"THE DRIVER I
N SECOND PLACE"
2780 PRINT AT 18,9;"IS NOW ";G$
2785 PRINT AT 19,11;"ON ";F;" LA
PS"
2790 NEXT P
2795 PAUSE 300
2799 GOTO 1535
2800 LET S=S+1
2802 PRINT AT 9,11;"   "
2803 PRINT AT 9,11;800-X
2810 PRINT AT 11,19;S
2815 IF S=10 THEN GOTO 2000
2820 LET A=A+1
2830 GOTO 850
3250 LET E=0
3260 LET F=0
3270 LET B$="NO ONE"
3299 RETURN
3500 IF S>6 THEN GOSUB 3550
3520 LET Z=Z+1
3530 PRINT AT A,Z;"[illegible]";AT A,Z;"[illegible]"
3549 RETURN
3550 LET X=X-50
3560 FOR M=1 TO 25
3570 PRINT AT 1,20;"REFUELLING"
3580 PRINT AT 1,20;"[illegible]"
3590 NEXT M
3595 PRINT AT 9,11;800-X
3599 RETURN
4000 PRINT AT 0,0;"[illegible]"
4010 PRINT AT 1,0;"[illegible]"
4020 PRINT AT 2,0;"[illegible]"
4030 PRINT AT 3,0;"[illegible]"
4040 PRINT AT 4,0;"[illegible]"
4050 PRINT AT 5,0;"[illegible]"
4060 PRINT AT 6,0;"[illegible]"
4070 PRINT AT 7,0;"[illegible]"
4080 PRINT AT 8,0;"[illegible]"
4090 PRINT AT 9,0;"[illegible]"
4100 PRINT AT 10,0;"[illegible]"
4110 PRINT AT 11,0;"[illegible]
LAP NO [illegible]"
4120 PRINT AT 12,0;"[illegible]"
4130 PRINT AT 13,0;"[illegible]"
4140 PRINT AT 14,0;"[illegible]"
4150 PRINT AT 15,0;"[illegible]"
4160 PRINT AT 16,0;"[illegible]"
4170 PRINT AT 17,0;"[illegible]"
4180 PRINT AT 18,0;"[illegible]"
4190 PRINT AT 19,0;"[illegible]"
4200 PRINT AT 9,11;800-X
4210 PRINT AT 11,19;S
4220 RETURN
```

The soft touch

James Walsh takes another look at the software market and explores some of the latest packages for the ZX Spectrum.

Magic Mountain – Phipps Associates

Magic Mountain is the first of three adventure games reviewed this month. Phipps Associates have a tradition of producing good adventures, and this seems to be no exception.

The Magic Mountain holds the ancient Scroll of Wisdom – a powerful document, much prized by the sorcerers. You must find it and survive to tell the tale!

I have been fortunate to see the solution to this adventure, which reveals the relative complexity and intrigue which surrounds the game. Phipps Associates have incorporated a split screen display with graphics in the upper half, and text in the lower. This improves the enjoyment of the game no end, and should be a minimum requirement of an adventure. Out of the four adventures reviewed here, this is the most professionally written and produced, and by far the most interesting.

Jumping Jack – Imagine

Imagine have produced a program which is, by today's standards, short of graphics and character, though one which is still quite fun to play.

Jack is stuck at the bottom of the screen and must jump onto the revolving platforms above him. He can only do this when there is a gap in the platform directly above him. There are twenty levels of platform which are harder to negotiate as you get higher. If you fall through a gap in the platform on which you are standing, you go down a level and get knocked out for a few seconds. If you are unlucky you may find yourself falling down a number of levels and unable to do anything about it. A life is only lost if you fall down to the lowest level.

Though the graphics and extent of the game are rather limited it is fairly addictive and fun to play.



Halls of the Things – Crystal Computing

How better to continue this issue's reviews than to be able to examine the first arcade style adventure game for the Spectrum. Sounds incredible? Well, it undoubtedly is. Imagine a game with ultra smooth, hi-res graphics, fast action, tactics and an addictive quality rarely surpassed – you have the Halls of the Things. This new game has successfully combined a fantasy world scenario with the finest quality, arcade style action.

You, the adventurer, are trapped at the entrance to an eight storey tower. By climbing the stairs on the outside you may gain entrance to the different floors, but to escape you must find the magical key which operates the drawbridge and your only chances of freedom. Unfortunately the key is hidden in the lowest dungeon, entrance to which can only be obtained if you have the seven spectral rings. These rings can be found scattered around the tower. To hinder your progress are the Things who are intelligent and highly destructive. You have a range of weapons including arrows, a sword, fireballs, etc. To stay alive and to heal after injury it is necessary to drink the bottles of elixir scattered throughout the tower.

For me this is the game of '83 so far, its only competitor being the Hobbit of '82. If this is the standard of imagination and innovation that we are to see in the future from Crystal Computing then the other software houses have a fight on their hands. Although it requires more thought than the arcade game, produced by such companies as Ultimate, it can be played by anyone who is prepared to spend five minutes getting used to it before hours and hours of sheer pleasure.

Velnor's Lair — Quicksilva

In this 'Dungeons and Dragons' type adventure you have the opportunity to be either a Warrior, Wizard or Priest, all of which has his or her own aptitudes and capabilities.

Although Velnor's Lair has no graphics it gains points by working on the principle of 'Dungeons and Dragons' in which instant death is very rare. Documentation is quite extensive and contained on the cassette inlay – a good point. Variation within the game is produced by various different spells, demons and ghastly creatures. The response and intelligence of the program is faster than many I have seen.

A good adventure and definitely well worth considering.

Corn Cropper — CCS

Corn Cropper is a simulation of a farm in which you are required to transform your £50,000 into £250,000 within 55 months.

This is possible by planting, harvesting, irrigating, spraying as well as buying and selling. From this small selection of the possible commands you can see that a fair amount of control is available. The computer also supplies you with information on the predicted weather, state of the farm, etc, and sometimes even an unexpected telex message every so often. In the past, many simulation games have either had too few parameters or were too complicated. But because of the particular subject chosen in this case they have been able to incorporate a large number of options without making it complicated.

This is one of the best simulations I have seen for the Spectrum, and can safely recommend it very highly.

3D Combat Zone - Artic Computing

3D Combat Zone is similar in nature to the arcade game, Combat Zone. Unfortunately, it suffers from some conditions not encountered on the original.

But before I go into these I feel bound to tell you a little about the game itself. You are in control of a tank on a landscape. There are 3D tanks seeking you out through the 3D objects on the landscape. In the tradition of the original, all objects are in outline. As time goes on other weird and



wonderful enemies appear, their object being, of course, to obliterate you.

This particular implementation, which is the first for the Spectrum I may add, suffers from jerky movement, slow reactions and an over intelligent enemy which I found almost impossible to destroy.

Shortly, other software companies should have their own versions of the game on the market (what these will be like we can but guess) but full marks to Artic for being the first.

Horace and the Spiders - Sinclair (Psion)

Horace is back, this time with a three stage game.

In stage one, Horace must climb the hills whilst jumping over the spiders. Stage two requires Horace to swing across a gorge on threads spun by the spiders. Unfortunately, if he remains on a thread too long a spider will hoist him up and inject him with its sometimes deadly venom.

If he survives this far he has to face a 'monster' situation, as in MikroGen's Panic, reviewed in the last issue. The spiders have spun their webs over the screen with connecting ladders. Horace must dig a hole in the web so that a spider will come and repair it. Whilst the spider is in the gap repairing it, Horace must jump on it repeatedly before it falls though and dies. My only complaint about this section is the fact that the spiders are too clever, and take a great deal of persuasion to repair a hole. The other stages could also have been extended slightly, but this might have taken the game to over 16K.

The Horace idea is novel and fun, which sums up this game, whilst adding that it is highly addictive.

Bridge Master - J. Keyne

Here we come to the only cassette which is not a game, but rather a tutor and opponent.

Calling Bridge Master a cassette can hardly do it justice, rather it is a package containing two computer cassettes, two commentary cassettes, full instructions, and a book written by Terence Reese, a world authority on bridge.

The idea of the package is that the commentary cassettes, which must be over three hours long all told, are played whilst following it on the computer. The computer itself acts as your partner and opponents, and cleverly it often will not allow you to play a poor card. The book itself is designed as background reading and for reference purposes. Overall one gets the impression that a great deal of work has been put into preparing this very professional package.

As a complete novice to the game of bridge I was in the ideal ▶

situation to realise just how well orientated it is towards the beginner. The commentary is clear, concise and friendly – quite different from the traditional crash courses in languages available. And that is another point, it is not a crash course, it works steadily and in a logical manner through the important points of bridge.

It is nice to be able to conclude this issue's reviews by recommending Bridge Master to the highest degree – absolutely excellent, and well worth the £24.95 (£19.95 for the ZX81).

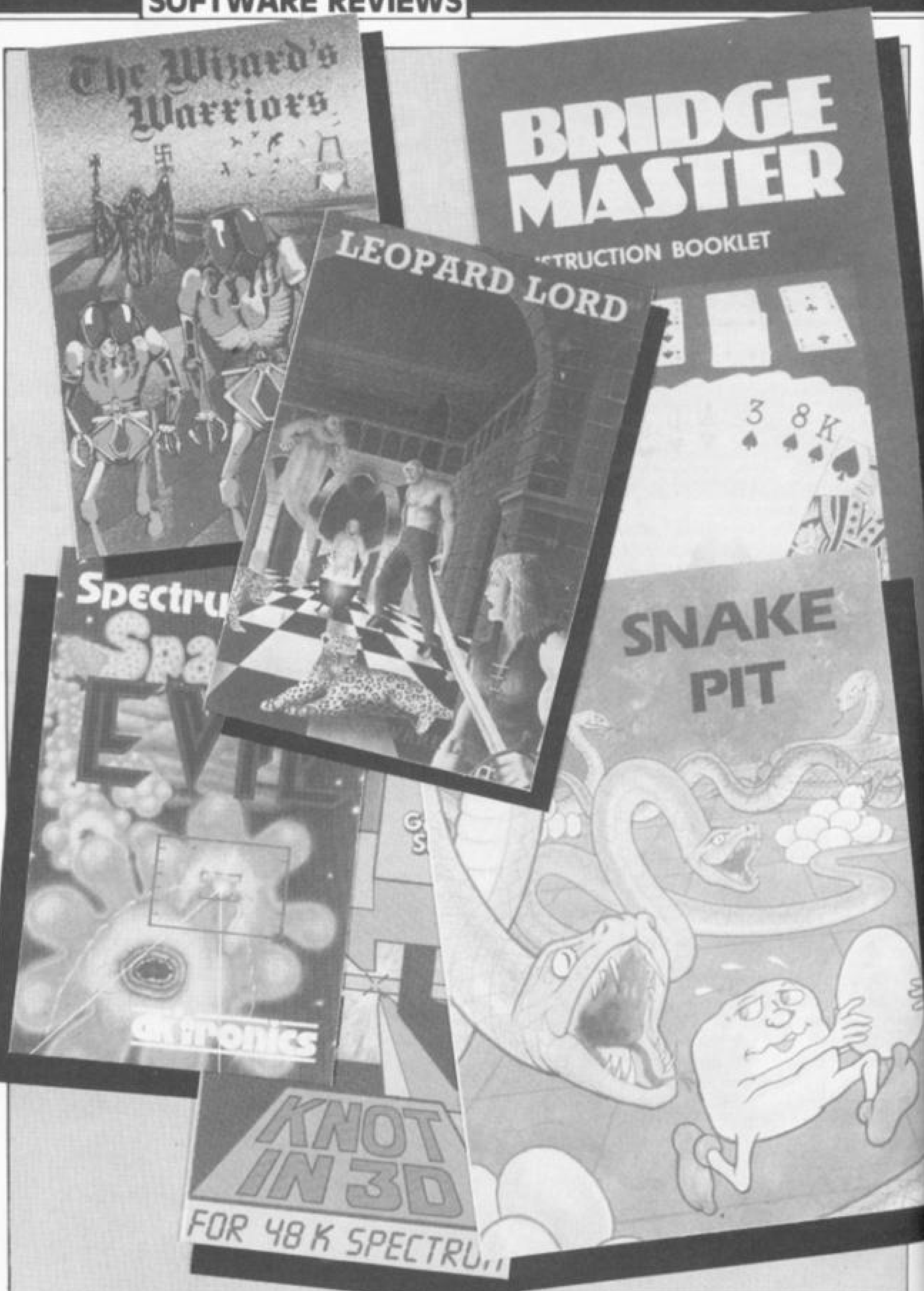
Automonopoli – Automata

Automonopoli is a full implementation of the famous game of 'Monopoly'. It allows for up to five players, with the computer participating if you require.

The whole width of the screen is used to display just 2½ locations. All the normal 'chance', mortgages and swapping facilities, etc, are available, plus fast recall of present property position. The computer amply takes care of the whole game, from throwing the dice to moving your piece. A surprising amount of excellent graphics are used to make a very impressive display indeed. The computer plays a very strong game, and doesn't even cheat!

For such an involved game, it is important to give full instructions, and these are provided on-screen. They are on the cassette inlay too, which makes life much easier if you forget something.

I can conclude by recommending this highly, especially for those frustrated people who have difficulty finding an opponent – your Spectrum has just learn to play!



Spawn of Evil – dk'Tronics

Deep in space alien spawn are going through a complex multi-stage breeding process, before maturing into their full attack potential. Your task is to break this cycle and so save yourself.

There are two screens – a long range scan in which the approximate position of the Spawn can be determined, and a short range window in which there is a sight to line up the aliens and destroy them. Two types of weapon are available – a short but accurate single blast, or a shower of less accurate fireballs.

The action is smooth and fast – often too fast. The idea of the game is pretty original, which coupled with the excellent graphics makes for a visually exciting game and one which is well worth playing.

Knot In 3D – New Generation

Malcolm Evans has produced a game in which you are stuck in a large 3D space in which an opposing craft wishes to 'knot' you with its and your trail. It is very much like a 3D blind alley.

Malcolm uses some of the best fast action colour graphics I have seen on the Spectrum so far. The trails which the crafts leave are shown as large blocks of colour, which produces an absolutely stunning display. Initially it is a little confusing, but one soon adjusts to the idea of perspective. The game finishes when you have collided too often with the trails left. Your status is shown at the bottom of the screen.

A highly original, professional and exciting game and one that I could play all night – very highly recommended.

The Wizard's Warriors – Abersoft

The name and packaging of this particular game give the impression that there is something rather special within. Unfor-

tunately, on the whole I was rather disappointed.

Wizard's Warriors is really only a rather more sophisticated rehash of the old favourite – 'Pac-man'. Not to say that this is either bad or poorly written, but rather that is unoriginal. The game is quite fun, though confusing at times – no proper warning is given if a life is lost and the Wizard's Warriors are often too intelligent to catch.

My advice is to play this game before you buy – you may like it, there is no reason why you should not, on the other hand you may already have one of the other dozen variations.

Leopard Lord – Kayde

This is the least well produced adventure of the cassettes reviewed this issue. The adventure is in BASIC and it does not even auto-start, ie it is necessary to type RUN to start – a very poor ommission. The game also simply ends if you die and has to be re-RUN. There are no graphics at all, which makes the game even less exciting.

Though I have seen worse adventures I would not be happy to recommend this one.

Snake Pit – Postern

When Snake Pit first starts the screen is full of eggs. You, the gobbler, are situated in the bottom right-hand corner. Eight snakes of assorted colours are placed in empty patches between the eggs. They cannot escape until a gap is made in the wall of eggs. There is one other snake though that is free to move right from the word 'go' – the red snake. It has the ability to eat any egg and, of course, you too. As soon as the other snakes are free they too will attempt to catch you, and devour you.

Your aim at this stage is to stay alive and eat as many eggs as possible. If you manage this then stage two commences – this time is is your turn to eat the snakes by biting their tails. If you have no success at this stage then the game re-starts.

Again the game is fun but a little unoriginal. For some reason only one life is allowed, which results in rather an abrupt end to the game.

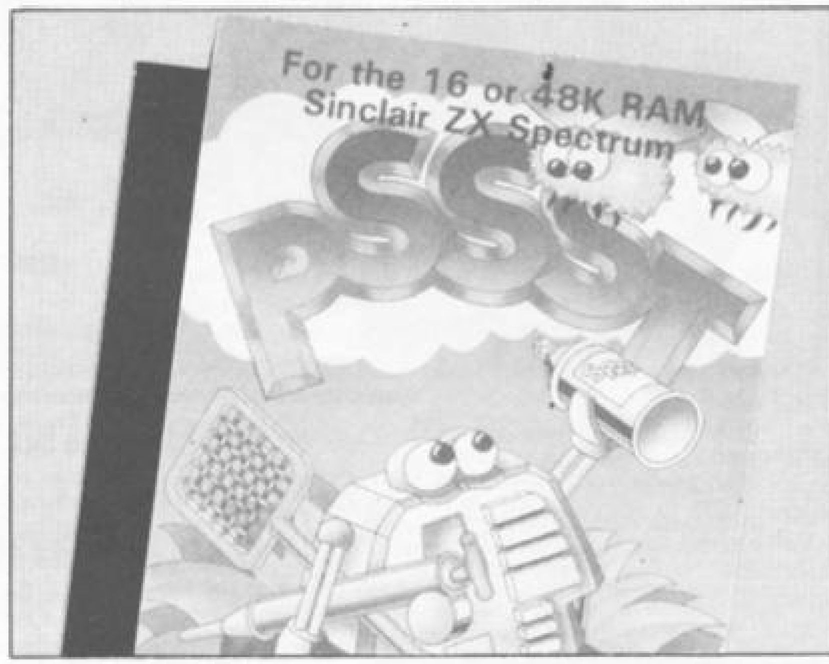
A reasonably simple but also quite addictive game, but one that can be frustrating at the same time.

PSSST – Ultimate

In the last issue I reviewed Jet-Pac, the first offering by Ultimate. Now I am pleased to have their latest game – PSSST. It uses much of the same type of fast, smooth and impressive graphics, which we are more accustomed to seeing on the fully fledged arcade machines.

In PSSST you are a robot (Robbie to be precise) and your task is to make sure that your plant grows and finally blossoms. To help it Robbie must collect bags of compost and flit swatters which periodically appear. To make things difficult a variety of pests are also adament that they wish to eat yor plant. To kill these Robbie must spray them with the right repellant – there are three to choose from. If your plant survives and blossoms a new stage starts with more pests.

The whole game is very professionally written and produced, with excellently smooth and detailed graphics. An original, highly addictive and very enjoyable game to play.



SUMMARY CHART

Names	Price	Memory Required	Documentation	Addictive Quality	Graphics	Programming Achievement	Lasting Appeal	Value
Halls of the Things	6.50	48	4	5	4½	5	5	5
Jumping Jack	5.50	16	3	4	3	3	3	3
Automonopoli	6.00	48	4½	4½	4½	4	4	4
PSST	5.50	16	4	5	5	4½	4½	4½
Wizard's Warriors	4.95	16	4	3½	3½	3½	3	3½
Snake Pit	7.99	16	4	4	3½	3½	3½	3½
Corn Cropper	6.00	16/48	4½	4½	4	3½	4½	4½
3D Combat Zone	5.95	48	4	3	4½	3½	3½	3½
Horace and the Spiders	5.95	16	3½	4½	4	4	4	4
Spawn of Evil	4.95	16	4	4	4	4	4	4
Knot in 3D	5.95	48	4	4½	5	4½	4½	4½
Magic Mountain	4.95	48	4	3½	4	3½	3½	4
Leopard Lord	9.95	48	3½	2½	0	2½	2	2½
Velnor's Lair	6.95	48	4½	3½	0	3½	3½	3½
Bridge Master	24.95	16	5	5	4	5	4	5

Addresses of Suppliers

Crystal Computing	2 Ashton Way, East Herrington, Sunderland SR3 3RX.
Imagine	Mason Buildings, Exchange Street East, Liverpool L2 3PN.
Automata	65a Osborne Road, Portsmouth, Hants PO5 3LR.
Ultimate	The Green, Ashby de la Zouch, Leicestershire LE6 5JU.
Postern	PO Box 2, Andover Ford, Cheltenham, Gloucestershire GL54 5SW.
CCS	14 Langton, Blackheath, London SE3 7TL.
Artic Computing Ltd	396 James Reckitt Avenue, Hull, North Humberside HU8 0JA.
Sinclair Research	FREEPOST, Camberley, Surrey GU15 3BR.
New Generation	The Brooklands, 15 Sunnybank, Lyncombe Vale, Bath, Avon.
Phipps Associates	99 East Street, Epsom, Surrey KT17 1EA.
J. Keyne	PO Box 163, Slough SL2 3YY.
Kayde	The Conge, Great Yarmouth, Norfolk NR30 1PJ.
Quicksilva Ltd	Palmerstone Park House, 13 Palmerston Road, Southampton SO1 1LL.
Abersoft	7 Maes Afallen, Bow Street, Dyfed SY24 5BA.
dk'Tronics	Unit 2, Shire Hill Industrial Estate, Saffron Walden, Essex

Problem page



Peter Shaw dons his thinking cap and plows through another pile of problems.

Dear Peter,
The letter from B.L. Richardson in the June/July issue concerns a problem which I have also experienced.

When running the Psion/Mikro-Gen program 'Space Raiders' in conjunction with a Memotech RAM the game runs with no control possible by the player using the normal input keys. Correspondance with both companies concerned shows that Memotech have not designed their RAMs in an identical and compatible fashion to those of Sinclair. Hence, when this particular program is loaded, it looks at the 8-16K area to see if a joystick is fitted and because of the Memotech system thinks it has found one, although in reality, one is not fitted. The program then runs with the previously described results.

A modified version of the program is being produced for Memotech users, but I don't know if this is yet available.

B. Harris
Oegstgeest,
The Netherlands.

Mr. Harris,
Unfortunately I misunderstood B.L. Richardson's problem, but now I fully understand. I rang Psion who told me much the same as you have said in your letter and also told me that the modified versions of Space Raider have been sent out to Memotech. They did stress that this problem is not a bug in the software, but merely incompatibility of the RAM packs. If anyone else has had similar problems with other software, then please write and tell me.

Dear Peter,
I am using a 48K Spectrum for business computing, handling office accounts, banking, sales ledgers, etc, and two shortcomings reduce its effectiveness against more expensive competitors. One is the slight flickering of the TV display, and the other is the 24 x 32 display.

I will be interfacing two Spectrums with an Epsom MX80 printer in the near future and would like to know is there any hardware or software manufacturers who market programs or gadgets to give a screen character display equal to the capabilities of the printer, and improve the quality of the display.

A. Welsh
Jakarta,
Indonesia.

Mr. Welsh,
Tasman Software produce a word processor program called Tasword Two, which creates a screen display of 64 x 24. For a small charge they may be able to produce a program which can give you the display without the word processor. To improve your display, Fountain Computers produce a sheet called 'Improving your Spectrum display' for £1.

Dear Peter,
Looking through the June/July issue of *ZX Computing*, I found a program 'Weather report', which interested me. The problem is that I own a Spectrum, and this particular program is for the ZX81.

However, undaunted, I typed in the program, but came to grief over three commands my machine doesn't have. These are; LET LINE = (number), which the Spectrum will not accept; SCROLL and MARK = (number) which are not on the Spectrum keyboard. Can you advise me how to modify the program slightly so that the Spectrum will accept it? Also, the command LPRINT confuses me. Could you explain it please? Why not just use PRINT?

Julian Silverton,
Streatham,
London.

Julian,
Your problem is not uncommon, I'm sure even owners of ZX81s who typed in the program looked for commands like LINE and MARK on their keyboards. Both these 'commands' are actually variables, and should therefore be typed in letter by letter. The SCROLL command, is not, as you say, available on the Spectrum. This can be simply replaced by RANDOMISE USR 3280. Our American readership cannot use this USR command on their TS 2000s (when they get them), they must use:

POKE 23692, – 1:PRINT AT 21,0;'

Dear Peter,
Recently, when I was using my ZX Spectrum I typed in the following lines:

```
10 FOR n=0 TO 1000
20 PRINT n;
30 NEXT n
```

On running this short program, the Spectrum proceeded to count from zero to 1000. After a screenful of figures I had the usual 'Scroll?' question. Instead of pressing any key I pressed the Caps and Symbol Shift keys together. This gave a report RUN followed by the extended mode cursor. On pressing the Enter key the screen filled with a mutation of the character set and the report code 'K Invalid colour'.

I have also noticed that if the program is started with another command, eg GO TO 0, then that command will appear as the pre-mutation report.

Have I discovered another one of the Spectrum's bugs?

Jon Goddar,
St. Bridges Major,
Mid Glamorgan.

Jon,
It is a bug that you have found, but it is a pretty obscure one. It seems that whenever you press a combination of keys which change the cursor state, ie Caps Lock or Graphics, the contents of the keyboard buffer is reprinted, and then a lot of rubbish is printed on the screen. I don't know why it does it, but the problem is not that great, although quite interesting. If any of the readers have suggestions as to what causes this to happen I would be very interested to hear from them.

As a final note in this issue, I have had a number of enquiries concerning starting Computer Clubs. If you would like to start a Computer Club in your area, but are not too sure about the legal side, or what you need to do to actually get going, then send a SAE to Peter Shaw, Computer Clubs, ZX Computing, 145 Charing Cross Road, London WC2H OEE. I have written a short checklist for all those amongst you who are in need of help.

3D noughts crosses

Add a new dimension to this popular game with this program for your 48K Spectrum from Bill Welch of Herne Hill.

This is a game played on a cubical 'board' containing 27 spaces, any one of which can be filled with a nought or a cross. The board is represented on the screen by three conventional noughts and crosses boards placed one above the other. The levels are labelled A, B and C and the spaces on each level are numbered from one to nine. The object of the game is not to make the first row of three — that is too easy for the player who goes first — but to make more complete rows than your opponent, the computer.

When the program is RUN, the computer asks you to choose a skill level, then draws the board and asks if you want to go first. The computer plays the 'X' and you play the 'O'. Any row of three will count, whether horizontal, vertical or diagonal; some of them are hard to spot at first, but you'll soon get the hang of it. There are 49 possible rows. Examples: A1, B1 and C1 make a row, and so do A1, B5 and C9. If you change your mind halfway through entering a move, press any obviously wrong key and you will be able to start your entry again.

In between each move the computer checks through all the possible rows and counts any completed ones by making an audible blip. The blip is higher for the computer's rows than for yours, so you can listen to your progress.

The computer is hard to beat at first, especially at level three, but it can be done, especially if you go first! Why not try to improve the computer's game? You can see how its strategy is organised by reading the program notes and you could, for example, change the order in which it checks for almost complete rows by changing the order of the numbers 1-49 in the DATA statements at lines 1060-1080.

Variables

To save on memory use, most of the variables are only temporary, and are used for different purposes in different parts of the program. These are the variables which have a single constant use:

a$ — Contains the character of the key last pressed when an input was requested.

a() — An array containing one element for each of the 27 spaces on the board.

b() — an array containing one element for each of the 49 possible rows of three.

level — The skill level which has been selected.

posn — The number of the element of a() corresponding to the move which has been selected by you or the computer.

go — The number of moves which have been made.

m — An indicator of whose turn it is to move.

Other variables used are: g, f, a, b, p, q, t and no.

Memory

As listed, this program will not run on a 16K machine — it uses more than 8,300 bytes. However, it could be compressed for a 16K machine by omitting the REM statements and perhaps using some of the standard Sinclair memory saving methods. For example, numbers can be referred to using the VAL function, eg, PRINT AT VAL"22", VAL "2"; and so on. Again, some of the lines can be run together with the use of colons.





Program notes

Line 5 Calls the instructions subroutine at line 9900.

Lines 20-70 Define the 'X' and 'O' graphics characters. This short routine, with the appropriate DATA statements, can be used to define any number of characters up to the maximum of 21.

Lines 80-90 Initialise the arrays a() and b(), and the move counter, and set the screen attributes for the game.

Line 95 POKE 23658,8 sets Caps Lock at capitals, which simplifies mug-trapping. POKE 23659,1 allows you to PRINT AT line 22.

Lines 100-175 Set up the board.

Lines 180-198 Set who is to go first. Line 190 calls an INKEY$ subroutine at line 9500 which stores the key pressed in a$. Note line 194; the effect of the commas after a PRINT AT statement is to blank out half a line per comma in the current PAPER colour. m is set to zero when it is the computer's move, and one when it is your move. If the computer is to go first, the program jumps to 1000.

Lines 200-350 Ask for your move, and mug-trap the results (again returned in a$). An acceptable move is turned into a number from one to 27 and stored in the variable, posn, for use later when displaying the move on the screen. The corresponding element of array a() is checked to see if it is empty; if it is, a four is inserted. (Four is used for human's moves, and one for the computer's moves.) The program then jumps to line 8000.

Lines 1000-7910 These are used for the computer's moves.

Line 1005 Lets you know that the computer is working out its move. After each stage of working, if the computer has not found an acceptable move it will add an extra full stop after 'I'M THINKING . . .' so that you can see how hard it has had to think!

Lines 1010-1025 If the centre space is empty, the computer will always choose to go there. The centre space corresponds to element 14 in array a(). Once a move has been chosen, the computer always jumps to line 8000. If the centre space has already been filled, the computer will move on to line 1030.

Line 1030 At skill level one, the computer skips the rest of its strategy and jumps to a routine at line 7000 which generates a random move.

Lines 1060-1080 Contain DATA which tells the computer the order in which it is to scan array b() for the next steps in its strategy.

Line 1105 At skill level two, the computer skips the next two steps of its strategy.

Lines 1110-1135 Each element of array b() contains the sum of the numbers held in three elements of array a() corresponding to a row of three spaces on the board. For example, a(1) plus a(2) plus a(3) corresponds to the state of the row from the top far left of the board (space A1) to the top far right (space A3). This total is stored in one of the elements of array b(). In this section of the program, the computer checks through array b() looking for the number '8', which represents a row on the board containing two 'O's and an empty space. If the computer finds such a row, it jumps to a routine at line 7500 which will identify the empty space so that the computer can put an 'X' there to block your row.

Lines 1140-1175 If you are not in a position to complete a row next move, the computer checks through array b() again, this time looking for the number '2'. This corresponds to a row on the board containing two Xs and a blank space. If such a row is found, the computer again jumps to line 7500 so that it can identify the empty space and complete a row of Xs.

Lines 1180-2010 Failing these, the computer looks for a row containing two blank spaces and one X. If it finds one, it will insert another X, threatening to complete a row on its next move.

Lines 2015-2055 If the computer can find none of these possibilities, it will check array a() in the order given in the DATA statement in line 2055 to see if any of the centre face or corner spaces are empty. It will make its move in the first one it finds. Plenty of space is left between lines 2055 and 7000 to insert more checks if you

want to elaborate on the computer's strategy.

Lines 7000-7030 Generate a random move in any empty space on the board.

Lines 7500-7800 Contain a routine used by the computer to find which of the spaces, in a line it has identified in one of its scans of array b(), is empty. On exiting from this routine, the temporary variable, a, indicates the appropriate empty element in array a().

Line 7900 Puts the computer's move into array a() and also into the variable, posn, for later use when displaying the move.

Lines 8000-8080 Find the correct screen address for the selected move and print an 'X' or 'O', as appropriate. The 'O' is a Graphics A and the 'X' is a Graphics B. The selected move is also displayed at the bottom of the screen.

Lines 8500-8745 Scan through array a() in all the combinations of three elements which correspond to a row of three on the board. In each case the sum of the three elements is stored in an element of array b() by means of a subroutine at line 9600. The temporary variable, a, is given the value 9600 to shorten the repeated calls to this subroutine.

Lines 8750-8770 Increase the move counter by one and check for the end of the game.

Line 8810 Blanks out the message line at the bottom of the screen.

Line 8820 If m is one, it becomes zero; if zero, it becomes one. This indicates whether it is your move or the computer's. This neat line was borrowed from J.A. Enness's program, Squareology, in *ZX Computing*, Summer 1982.

Line 8830 Jumps to line 1000 if it is the computer's move next, or line 200 if it is your move next.

Lines 9000-9050 When the game is over, this routine counts the completed rows of Os and Xs by scanning array b().

Lines 9200-9480 Display the final score and suitable messages, with jubilant or otherwise sound effects. (Room for improvement here, if you're interested.) You are asked if you want to play again. After the POKEs in line 95, if you break into direct command mode without POKE 23659,2 (line 9460) you will get a *very* strange screen display!

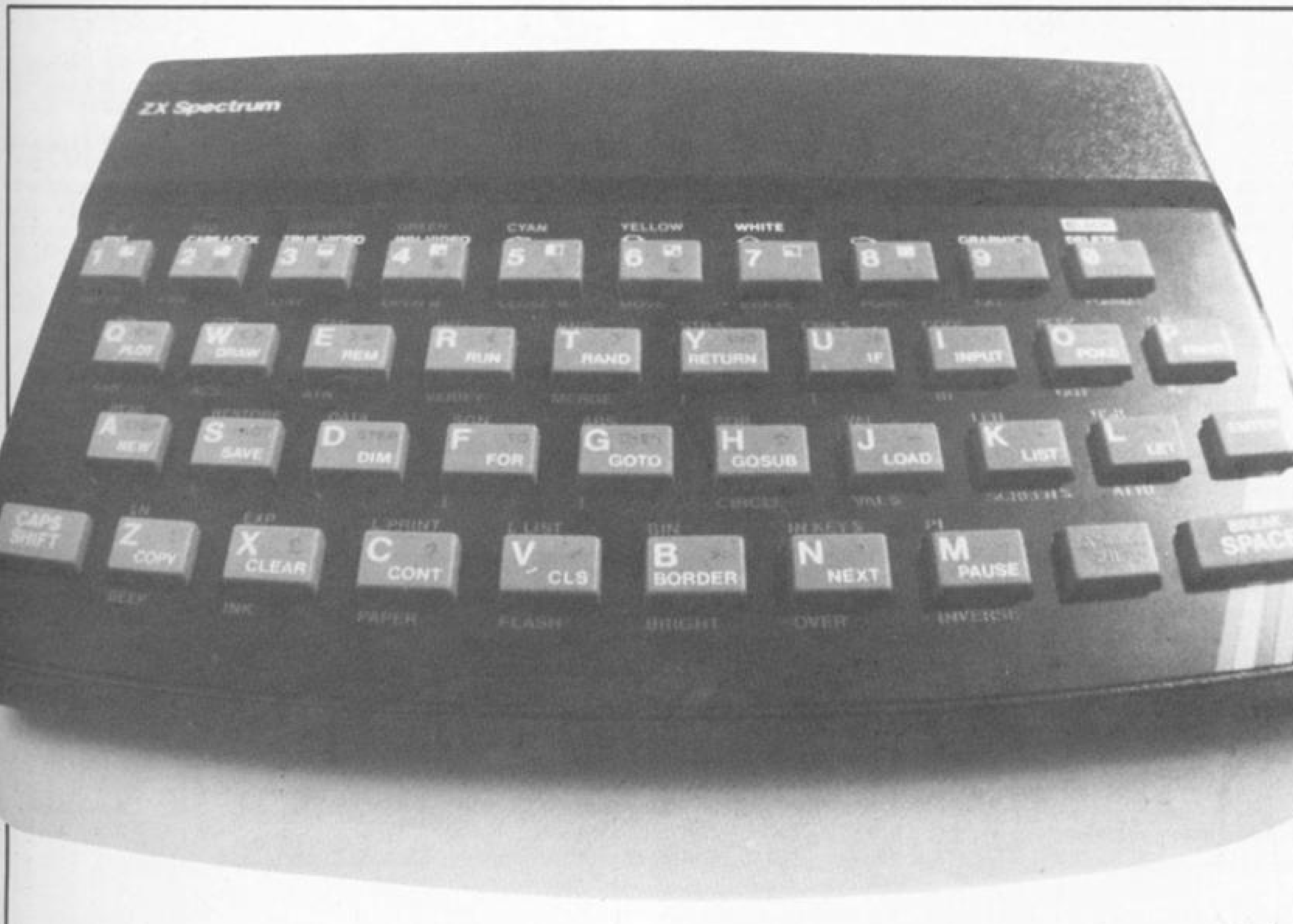
Lines 9500-9540 Contain an INKEY$ subroutine which waits for a key to be pressed, and stores the result in a$ for return.

Lines 9600-9640 Contain the subroutine used by the section of the program starting at line 8500. After each move, it stores the state of each possible row of three in an element of array b(). It gives a low blip when it finds a row of Os, and a higher one when it finds a row of Xs. It keeps quiet about mixed or empty lines.

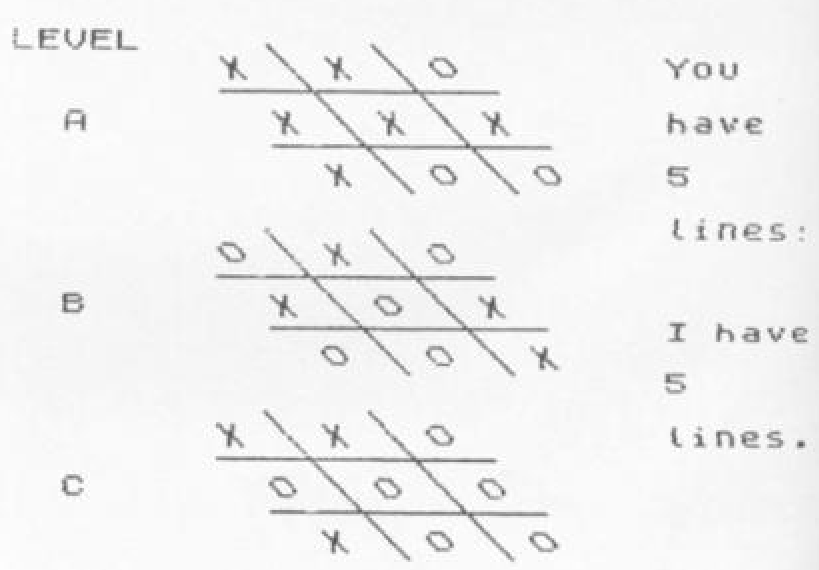
Lines 9900-9995 Contain the subroutine which displays the instructions and sets the skill level.

```
   1 REM 3-D NOUGHTS AND CROSSES
   2 REM
   3 REM by Bill Welch
   4 REM
   5 GO SUB 9900
  10 REM DEFINE CHARACTERS
  20 FOR g=144 TO 145: FOR f=0 TO 7
  30 READ a
  40 POKE USR CHR$ g+f,a
  50 NEXT f: NEXT g
  60 DATA 0,120,132,130,65,33,30,0
  70 DATA 0,136,72,56,24,20,18,17
  80 REM INITIALISE
  85 DIM a(27): DIM b(49): LET g5=0
  90 BORDER 1: PAPER 1: INK 4: CLS
  95 POKE 23658,8: POKE 23659,1
 100 REM PRINT BOARD
 105 FOR f=1 TO 15 STEP 7
 110 LET b=8: LET a=49
 115 FOR p=f TO f+5 STEP 2
 120 FOR q=b TO b+9 STEP 4
 125 PRINT AT p,q; INK 5;CHR$ a
 130 LET a=a+1: NEXT q
 135 LET b=b+2
 140 NEXT p: NEXT f
 145 FOR f=14 TO 127 STEP 56
 150 PLOT 122,f: DRAW -44,44
 155 PLOT 154,f: DRAW -44,44
 160 PLOT 80,f+14: DRAW 84,0
 165 PLOT 64,f+30: DRAW 84,0
 170 NEXT f
 175 INK 6: PRINT AT 0,0;"LEVEL";AT 3,2;"A";AT 10,2;"B";AT 17,2;"C"
 180 REM DECIDE WHO GOES FIRST
 185 PRINT AT 22,2;"Do you want to go first?": BEEP .05,40
 190 GO SUB 9500
 192 IF a$<>"Y" AND a$<>"N" THEN BEEP .1,-24: GO TO 190
 194 PRINT AT 22,2,,
 196 IF a$="N" THEN LET m=0: GO TO 1000
 198 LET m=1
 200 REM HUMAN'S MOVE
 210 PRINT AT 0,25;"Your";AT 2,25;"move?"
 220 PRINT AT 8,25;"Press";AT 10,25;"level";AT 12,24;"(A,B,C)"
 230 PRINT AT 16,25;"then";AT 18,25;"number";AT 20,24;"(1 - 9)"
 235 BEEP .05,40
 240 GO SUB 9500
 245 IF a$<>"A" AND a$<>"B" AND a$<>"C" THEN BEEP .1,-24: GO TO 240
 250 BEEP .08,31
 260 LET a=CODE a$-64
 270 PRINT AT 22,0;"YOUR MOVE IS ";a$;"-              ";: PRINT AT 22,15;
 280 GO SUB 9500
 290 IF a$<"1" OR a$>"9" THEN BEEP .1,-24: PRINT "? Start again.": GO TO 240
 300 PRINT a$: BEEP .1,31
 310 LET posn=VAL a$+(9 AND a=2)+(18 AND a=3)
 320 IF a(posn)<>0 THEN BEEP .1,-24: PRINT AT 22,0;"That place is full: try again.": GO TO 240
 330 LET a(posn)=4
 340 FOR p=0 TO 21 STEP 2: PRINT AT p,24;"        ": NEXT p
 350 GO TO 8000
1000 REM COMPUTER'S MOVE
1005 PRINT AT 22,0;"I'M THINKING...";: BEEP .005,12
1010 REM Is centre filled?
1020 IF a(14)=0 THEN LET a(14)=1: LET posn=14: GO TO 8000
1025 PRINT ".";: BEEP .005,12
1030 IF level=1 THEN GO TO 7000
1050 REM Search for 3 in a row
1060 DATA 14,23,5,48,46,49,47,33,28,39,36,45,43,40,37,30,31,34,42
1070 DATA 25,1,12,9,10,19,7,3,18,21,27,16,35,44,32,29,41,38
1080 DATA 11,20,15,17,2,8,4,26,22,6,13,24
1100 REM First human's lines
1105 IF level=2 THEN GO TO 1180
1110 RESTORE 1060
1115 FOR f=1 TO 49
1120 READ t
```

```
1125 IF b(t)=8 THEN GO TO 7500
1130 NEXT f
1135 PRINT ".";: BEEP .005,12
1140 REM then, computer's lines.
1145 RESTORE 1060
1150 FOR f=1 TO 49
1155 READ t
1160 IF b(t)=2 THEN GO TO 7500
1170 NEXT f
1175 PRINT ".";: BEEP .005,12
1180 REM Can computer line 2 up?
1185 RESTORE 1060
1190 FOR f=1 TO 49
1195 READ t
2000 IF b(t)=1 THEN GO TO 7500
2005 NEXT f
2010 PRINT ".";: BEEP .005,12
2015 REM If not, look for empty
     faces and corners.
2020 RESTORE 2055
2025 FOR f=1 TO 14
2030 READ t
2035 IF a(t)=0 THEN LET posn=t:
LET a(t)=1: GO TO 8000
2040 NEXT f
2050 PRINT ".";: BEEP .005,12
2055 DATA 15,23,5,13,23,11,27,19
,3,7,1,21,25,9
7000 REM If none, random move.
7010 LET posn=INT (RND*27)+1
7020 IF a(posn)=0 THEN LET a(pos
n)=1: GO TO 8000
7030 BEEP .005,12: GO TO 7000
7500 REM Find gap in line.
7505 LET a=0
7510 IF t<10 THEN FOR p=t TO t+1
8 STEP 9
7515 IF t>9 AND t<19 THEN LET q=
((t-9) AND t<13)+((t-3) AND (t<1
6 AND t>12))+((t+3) AND t>15): F
OR p=q TO q+7 STEP 3
7520 IF t>18 AND t<28 THEN LET q
=(t-19)*3+1: FOR p=q TO q+2
7530 IF t>27 AND t<31 THEN LET q
=t-27: FOR p=q TO q+24 STEP 12
7540 IF t>30 AND t<34 THEN LET q
=(t-31)*3+1: FOR p=q TO q+20 STE
P 10
7550 IF t>33 AND t<37 THEN LET q
=t-27: FOR p=q TO q+12 STEP 6
7560 IF t>36 AND t<40 THEN LET q
=(t-37)*3+3: FOR p=q TO q+16 STE
P 8
7570 IF t>39 AND t<43 THEN LET q
=(t-40)*9+1: FOR p=q TO q+8 STEP
 4
7580 IF t>42 AND t<46 THEN LET q
=(t-43)*9+3: FOR p=q TO q+4 STEP
 2
7590 IF t=46 THEN FOR p=1 TO 27
STEP 13
7600 IF t=47 THEN FOR p=3 TO 25
STEP 11
7610 IF t=48 THEN FOR p=7 TO 21
STEP 7
7620 IF t=49 THEN FOR p=9 TO 19
STEP 5
7800 LET a=a+(p AND (a=0 AND a(p
)=0)): NEXT p
7900 REM Record computer's move.
7910 LET posn=a: LET a(a)=1
8000 REM PRINT MOVE
8010 IF m=0 THEN PRINT " ";CHR$
(CODE "B"-(1 AND posn<10)+(1 AND
 posn>18));"-";posn-(9 AND posn>
```

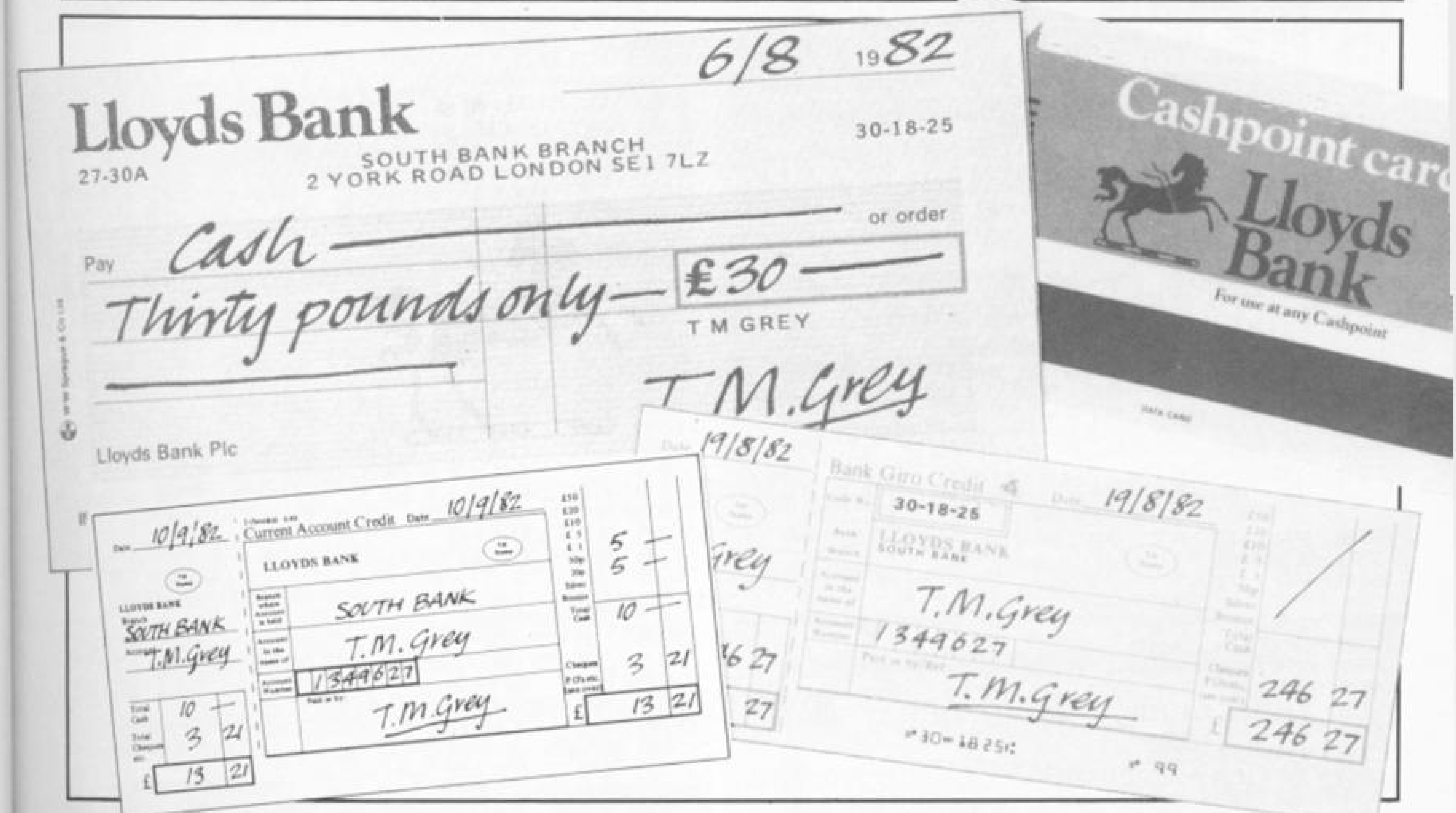


```
9)-(9 AND posn>18)
8030 LET a=8-(7 AND posn<10)+(7
AND posn>18)
8040 LET no=posn-(18 AND a=15)-(
9 AND a=8)
8050 LET p=a+(2 AND no>3)+(2 AND
 no>6)
8060 LET q=p-a+8
8070 LET q=q+(4 AND (no=2 OR no=
5 OR no=8))+(8 AND (no=3 OR no=6
 OR no=9))
8080 BEEP .01,36: PRINT INK 7; B
RIGHT 1;AT p,q;("A" AND m=1)+("B
" AND m=0)
8500 REM SEARCH THROUGH LINES
8505 LET a=9600: LET b=1
8510 FOR p=1 TO 9
8515 LET q=a(p)+a(p+9)+a(p+18)
8520 GO SUB a
8525 NEXT p
8530 FOR p=1 TO 21
8535 IF p=4 THEN LET p=10
8540 IF p=13 THEN LET p=19
8545 LET q=a(p)+a(p+3)+a(p+6)
8550 GO SUB a
8555 NEXT p
8560 FOR p=1 TO 25 STEP 3
8565 LET q=a(p)+a(p+1)+a(p+2)
8570 GO SUB a
8575 NEXT p
8580 FOR p=1 TO 3
8585 LET q=a(p)+a(p+12)+a(p+24)
8590 GO SUB a
8595 NEXT p
8600 FOR p=1 TO 7 STEP 3
8605 LET q=a(p)+a(p+10)+a(p+20)
8610 GO SUB a
8615 NEXT p
8620 FOR p=7 TO 9
8625 LET q=a(p)+a(p+6)+a(p+12)
8630 GO SUB a
8635 NEXT p
8640 FOR p=3 TO 9 STEP 3
8645 LET q=a(p)+a(p+8)+a(p+16)
8650 GO SUB a
8655 NEXT p
8660 FOR p=1 TO 19 STEP 9
8665 LET q=a(p)+a(p+4)+a(p+8)
8670 GO SUB a
8675 NEXT p
8680 FOR p=3 TO 21 STEP 9
8685 LET q=a(p)+a(p+2)+a(p+4)
8690 GO SUB a
8695 NEXT p
8710 LET q=a(1)+a(14)+a(27)
8715 GO SUB a
8720 LET q=a(3)+a(14)+a(25)
8725 GO SUB a
8730 LET q=a(7)+a(14)+a(21)
8735 GO SUB a
8740 LET q=a(9)+a(14)+a(19)
8745 GO SUB a
8750 REM IS GAME OVER?
8760 LET go=go+1
8770 IF go=27 THEN GO TO 9000
8800 REM GO TO NEXT MOVE
8810 PRINT AT 22,0,,
8820 LET m=ABS (m-1)
8830 GO TO 1000-(800 AND m)
9000 REM COUNT COMPLETED LINES
9010 LET a=0: LET b=0
9020 FOR f=1 TO 49
9030 IF b(f)=3 THEN LET a=a+1
9040 IF b(f)=12 THEN LET b=b+1
9050 NEXT f
9200 REM PRINT FINAL SCORE
9210 PRINT AT 1,25;"You";AT 3,25
;"have";AT 5,25;b;AT 7,25;"line"
+("s" AND b<>1);":"
9220 PRINT AT 11,25;"I have";AT
13,25;a;AT 15,25;"line"+("s" AND
 a<>1);"."
9230 IF a>b THEN GO TO 9300
9240 IF b=a THEN GO TO 9400
9250 PRINT AT 22,0;"You win, cur
se it. Another game?"
9260 BEEP 1,-12
9270 GO TO 9430
9300 PRINT AT 22,0; FLASH 1;"I W
IN AGAIN!";
9310 PRINT " Another try,sucker?
"
9320 FOR g=1 TO 5: FOR f=12 TO 3
6 STEP 10: BEEP .05,f: NEXT f: N
EXT g
9330 GO TO 9430
9400 PRINT AT 22,0;"       "; INVE
RSE 1;"DRAW";
9410 PRINT "     Another game?"
9420 BEEP .5,24
9430 GO SUB 9500
9440 IF a$<>"Y" AND a$<>"N" THEN
 BEEP .1,-24: GO TO 9430
9450 PRINT AT 22,0,,
9460 POKE 23659,2
9470 IF a$="Y" THEN RUN
9480 FOR f=12 TO 0 STEP -1: BEEP
 .05,f: NEXT f: STOP
9500 REM INKEY$ ROUTINE
9510 IF INKEY$<>"" THEN GO TO 95
10
9520 IF INKEY$="" THEN GO TO 952
0
9530 LET a$=INKEY$
9540 RETURN
9600 REM STORE STATE OF LINES
9610 LET b(b)=q
9620 IF q=12 OR q=3 THEN BEEP .0
1,16+(12 AND q=3)
9630 LET b=b+1
9640 RETURN
9900 REM INSTRUCTIONS
9910 BORDER 4: PAPER 4: INK 0: F
LASH 0: BRIGHT 0: CLS
9920 PRINT AT 0,3; INVERSE 1;"3-
D NOUGHTS AND CROSSES"
9930 PRINT '''"The object of the
game is to    complete as many l
ines as you   can. The computer
will also try!"
9940 PRINT '"All straight lines
count,whetherhorizontal,vertical
 or diagonal.There are 49 possib
le lines."
9950 PRINT '''"Choose a skill le
vel:-"''TAB 4;"Press: 1 = dead e
asy",TAB 11;"2 = hard",TAB 11;"3
 = even harder"
9960 BEEP .05,40
9970 GO SUB 9500
9980 IF a$<"1" OR a$>"3" THEN BE
EP .1,-24: GO TO 9970
9990 LET level=VAL a$
9995 CLS : RETURN
```



A screen illustration from the program, 3D Noughts and Crosses.

Bank account



This program runs on a ZX81 with 16K RAM and allows you to examine and update five bank accounts.

A program you can bank on from Professor Salaman of Cardiff.

On account

Each account is displayed as a bank statement with the last entry and the balance as the last line. Updating is easy and reasonably foolproof. The bank statement appears almost instantly on the screen avoiding the use of the SCROLL command. The accounts are all held in string arrays and the program demonstrates good use of string handling.

All the data will be SAVEd on tape along with the program, but after re-LOADing the program from tape you must type GOTO 100 rather than RUN otherwise you will lose the lot! Unfortunately, it takes about six minutes to SAVE or LOAD and you may find periods of time where nothing seems to be happening — don't worry something is happening.

Obviously, the names of the accounts can be changed and if only three accounts are required, then lines 4000 to 5160 can be omitted. The program is user friendly and the prompts should be adequate to see you safely through the operation.

```
   5 REM "ACCOUNTS"
  10 DIM A$(50,32)
  12 DIM B$(50,32)
  14 DIM C$(50,32)
  16 DIM D$(50,32)
  18 DIM E$(50,32)
  21 DIM Y$(1,8)
  22 DIM H$(1,5)
  25 LET A$(3,25 TO )="      0.00"
  27 LET B$(3,25 TO )="      0.00"
  29 LET C$(3,25 TO )="      0.00"
  31 LET D$(3,25 TO )="      0.00"
  33 LET E$(3,25 TO )="      0.00"
  35 LET AN=3
  37 LET BN=3
  39 LET CN=3
  41 LET DN=3
  43 LET EN=3
  50 LET A$(1)="         CURRENT BAN
K ACCOUNT (MR)                 "
  55 LET A$(2)="
                               "
  60 LET B$(1)="         CURRENT BAN
K ACCOUNT (MRS)                "
  65 LET B$(2)="
                               "
  70 LET C$(1)="         BANK DEPOSI
T ACCOUNT                      "
  75 LET C$(2)="
                               "
  80 LET D$(1)="         BUILDING SO
CIETY ACCOUNT                  "
  85 LET D$(2)="
                               "
  90 LET E$(1)="         STOCKS AND
SHARES                         "
```

```
  95 LET E$(2)="▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀"
  99 SLOW
 100 CLS
 105 REM **MENU OPTIONS**
 110 PRINT "   ***SMITH FAMILY ACCOUNTS***"
 120 PRINT AT 3,0;"MONEY IS HELD IN THESE ACCOUNTS"
 130 PRINT AT 5,0;A$(1);AT 6,0;B$(1);AT 7,0;C$(1);AT 8,0;D$(1);AT 9,0;E$(1)
 140 PRINT AT 5,2;"1";AT 6,2;"2";AT 7,2;"3";AT 8,2;"4";AT 9,2;"5"
 145 PRINT AT 15,3;"WHICH ACCOUNT DO YOU WANT",,,,"1 2 3 4 OR 5 ?"
 150 INPUT F$
 160 IF CODE F$<29 OR CODE F$>33 THEN GOTO 150
 165 FAST
 170 GOSUB VAL F$*1000
 190 REM **MAKING A NEW ENTRY**
 200 PRINT AT 20,0;"  DO YOU WANT TO MAKE AN ENTRY ?"
 210 PRINT AT 21,9;"YES=Y NO=N"
 215 SLOW
 220 IF INKEY$="N" THEN GOTO 100
 230 IF INKEY$<>"Y" THEN GOTO 210
 240 PRINT AT 20,0;"ENTER DATE...EG:12MAR          "
 245 PRINT "                                "
 250 INPUT H$(1)
 255 GOSUB 800
 257 IF NOT OK THEN GOTO 250
 260 PRINT AT 17,0;H$(1);AT 20,0;"IS THIS CREDIT C OR DEBIT D ?"
 270 INPUT I$
 280 IF I$<>"C" AND I$<>"D" THEN GOTO 270
 290 PRINT AT 20,0;"ENTER AMOUNT £                  "
 300 INPUT X$
 303 GOSUB 900
 305 IF NOT OK THEN GOTO 300
 310 GOSUB 6000
 330 IF I$="C" THEN GOTO 420
 335 LET Z$=Y$(1)
 340 PRINT AT 17,6;Z$
 345 REM **WORKING OUT THE NEW TOTAL**
 350 IF F$="1" THEN LET X=VAL A$(AN,25 TO 32)-VAL Y$(1)
 360 IF F$="2" THEN LET X=VAL B$(BN,25 TO 32)-VAL Y$(1)
 370 IF F$="3" THEN LET X=VAL C$(CN,25 TO 32)-VAL Y$(1)
 380 IF F$="4" THEN LET X=VAL D$(DN,25 TO 32)-VAL Y$(1)
 390 IF F$="5" THEN LET X=VAL E$(EN,25 TO 32)-VAL Y$(1)
 410 GOTO 480
 430 IF F$="1" THEN LET X=VAL A$(AN,25 TO 32)+VAL Y$(1)
 440 IF F$="2" THEN LET X=VAL B$(BN,25 TO 32)+VAL Y$(1)
 450 IF F$="3" THEN LET X=VAL C$(CN,25 TO 32)+VAL Y$(1)
 460 IF F$="4" THEN LET X=VAL D$(DN,25 TO 32)+VAL Y$(1)
 470 IF F$="5" THEN LET X=VAL E$(EN,25 TO 32)+VAL Y$(1)
 472 LET Z$=Y$(1)
 475 PRINT AT 17,15;Z$
 480 LET X$=STR$ X
 490 GOSUB 6000
 500 LET K$=Y$(1)
 510 PRINT AT 17,24;K$
 550 PRINT AT 20,0;"   DO YOU WANT TO ENTER THIS ?    "
 555 PRINT "                 YES=Y   NO=N"
 560 IF INKEY$<>"N" AND INKEY$<>"Y" THEN GOTO 560
 570 IF INKEY$="N" THEN GOTO 100
 590 PRINT AT 20,0;"                   ENTERING DATA"
 600 PRINT "                                "
 610 GOSUB VAL F$*1000+100
 620 GOTO 99
 800 REM **DATE VERIFICATION**
 810 LET OK=0
 820 IF H$(1,1)<"1" OR H$(1,1)>"9" THEN RETURN
 830 IF H$(1,2)<"0" OR H$(1,2)>"9" THEN GOTO 850
 832 IF H$(1,3)>="0" AND H$(1,3)<="9" THEN RETURN
 833 IF VAL H$(1,1 TO 2)>31 THEN RETURN
 835 LET OK=1
 840 RETURN
 850 REM **DATE ALLIGNMENT**
 860 LET O$=H$(1,1 TO 4)
 870 LET H$(1,1 TO 5)=" "+O$
 880 LET OK=1
 890 RETURN
 900 REM **CASH VALIDATION**
 905 LET OK=0
 910 FOR D=1 TO LEN X$
 925 IF X$(D)="." OR X$(D)>="0" AND X$(D)<="9" THEN GOTO 930
 927 RETURN
 930 NEXT D
 940 IF D>8 THEN RETURN
 950 LET OK=1
 960 RETURN
1000 REM **PRINT ACCOUNT 1**
1005 CLS
1010 LET M=15
1015 PRINT AT 16,24;"▀▀▀▀▀▀▀▀"
1020 FOR G=AN TO 3 STEP -1
1023 PRINT AT M,0;A$(G)
1025 LET M=M-1
1027 IF M<4 THEN GOTO 1040
1030 NEXT G
1040 PRINT AT 0,0;A$(1);AT 1,0;A$(2)
1050 PRINT AT 2,0;"DATE  :  DEBIT  :  CREDIT  :  BALANCE"
1060 PRINT
1070 RETURN
1100 LET AN=AN+1
1110 LET A$(AN,1 TO 5)=H$(1)
1130 IF I$="D" THEN LET A$(AN,7
```



```
TO 14)=Z$
1140 IF I$="C" THEN LET A$(AN,16
 TO 23)=Z$
1145 LET A$(AN,6)=":"
1147 LET A$(AN,15)=":"
1149 LET A$(AN,24)=":"
1150 LET A$(AN,25 TO 32)=K$
1160 RETURN
2000 REM **PRINT ACCOUNT 2**
2005 CLS
2010 LET M=15
2015 PRINT AT 16,24;"▀▀▀▀▀▀▀▀"
2020 FOR G=BN TO 3 STEP -1
2023 PRINT AT M,0;B$(G)
2025 LET M=M-1
2027 IF M<4 THEN GOTO 2040
2030 NEXT G
2040 PRINT AT 0,0;B$(1);AT 1,0;B
$(2)
2050 PRINT AT 2,0;"DATE : DEBIT
 : CREDIT : BALANCE"
2070 RETURN
2100 LET BN=BN+1
2110 LET B$(BN,1 TO 5)=H$(1)
2130 IF I$="D" THEN LET B$(BN,7
TO 14)=Z$
2140 IF I$="C" THEN LET B$(BN,16
 TO 23)=Z$
2145 LET B$(BN,6)=":"
2147 LET B$(BN,15)=":"
2149 LET B$(BN,24)=":"
2150 LET B$(BN,25 TO 32)=K$
2160 RETURN
3000 REM **PRINT ACCOUNT 3**
3005 CLS
3010 LET M=15
3015 PRINT AT 16,24;"▀▀▀▀▀▀▀▀"
3020 FOR G=CN TO 3 STEP -1
3023 PRINT AT M,0;C$(G)
3025 LET M=M-1
3027 IF M<4 THEN GOTO 3040
3030 NEXT G
3040 PRINT AT 0,0;C$(1);AT 1,0;C
$(2)
3050 PRINT AT 2,0;"DATE : DEBIT
 : CREDIT : BALANCE"
3070 RETURN
3100 LET CN=CN+1
3110 LET C$(CN,1 TO 5)=H$(1)
3130 IF I$="D" THEN LET C$(CN,7
TO 14)=Z$
3140 IF I$="C" THEN LET C$(CN,16
 TO 23)=Z$
3145 LET C$(CN,6)=":"
3147 LET C$(CN,15)=":"
3149 LET C$(CN,24)=":"
3150 LET C$(CN,25 TO 32)=K$
3160 RETURN
4000 REM **PRINT ACCOUNT 4**
4005 CLS
4010 LET M=15
4015 PRINT AT 16,24;"▀▀▀▀▀▀▀▀"
4020 FOR G=DN TO 3 STEP -1
4023 PRINT AT M,0;D$(G)
4025 LET M=M-1
4027 IF M<4 THEN GOTO 4040
4030 NEXT G
4040 PRINT AT 0,0;D$(1);AT 1,0;D
$(2)
4050 PRINT AT 2,0;"DATE : DEBIT
 : CREDIT : BALANCE"
4070 RETURN
4100 LET DN=DN+1
4110 LET D$(DN,1 TO 5)=H$(1)
4130 IF I$="D" THEN LET D$(DN,7
TO 14)=Z$
4140 IF I$="C" THEN LET D$(DN,16
 TO 23)=Z$
4145 LET D$(DN,6)=":"
4147 LET D$(DN,15)=":"
4149 LET D$(DN,24)=":"
4150 LET D$(DN,25 TO 32)=K$
4160 RETURN
5000 REM **PRINT ACCOUNT 5**
5005 CLS
5010 LET M=15
5015 PRINT AT 16,24;"▀▀▀▀▀▀▀▀"
5020 FOR G=EN TO 3 STEP -1
5023 PRINT AT M,0;E$(G)
5025 LET M=M-1
5027 IF M<4 THEN GOTO 5040
5030 NEXT G
5040 PRINT AT 0,0;E$(1);AT 1,0;E
$(2)
5050 PRINT AT 2,0;"DATE : DEBIT
 : CREDIT : BALANCE"
5070 RETURN
5100 LET EN=EN+1
5110 LET E$(EN,1 TO 5)=H$(1)
5130 IF I$="D" THEN LET E$(EN,7
TO 14)=Z$
5140 IF I$="C" THEN LET E$(EN,16
 TO 23)=Z$
5145 LET E$(EN,6)=":"
5147 LET E$(EN,15)=":"
5149 LET E$(EN,24)=":"
5150 LET E$(EN,25 TO 32)=K$
5160 RETURN
6000 REM **CASH ALLIGNMENT**
6005 LET Y$(1)=""
6010 FOR M=1 TO LEN X$
6020 IF X$(M)="." THEN GOTO 6070
6030 NEXT M
6040 LET Y$(1,(7-M) TO 5)=X$
6050 LET Y$(1,6 TO 8)=".00"
6060 RETURN
6070 LET Y$(1,(7-M) TO 8)=X$
6080 RETURN
```

```
      ***SMITH FAMILY ACCOUNTS***

MONEY IS HELD IN THESE ACCOUNTS

  1  CURRENT BANK ACCOUNT (MR)
  2  CURRENT BANK ACCOUNT (MRS)
  3  BANK DEPOSIT ACCOUNT
  4  BUILDING SOCIETY ACCOUNT
  5  STOCKS AND SHARES


     WHICH ACCOUNT DO YOU WANT

                1 2 3 4 OR 5 ?
```

When you use this program, you will first be greeted with a menu of the various accounts you possess and you will be asked for which account you wish to access. (No pun intended!)

```
     CURRENT BANK ACCOUNT (MR)
DATE :  DEBIT  : CREDIT  : BALANCE


                              0.00
12JUN:         : 1632.76: 1632.76
23JUN: 2519.00:         : -886.24
27JUN:         :  465.32: -420.92
 1JUL:         : 3412.07: 2991.15
 3JUL:  156.23:         : 2834.92
10JUL:  239.00:         : 2595.92
18JUL:   43.56:         : 2552.36
22JUL:   87.33:         : 2465.03
 1AUG:         :  126.45: 2591.48
 7AUG: 1137.82:         : 1453.66

   DO YOU WANT TO MAKE AN ENTRY ?
          YES=Y  NO=N
```

Should you press the '1' key you will be presented with the above on-screen. You will then be asked if you wish to make a new entry.

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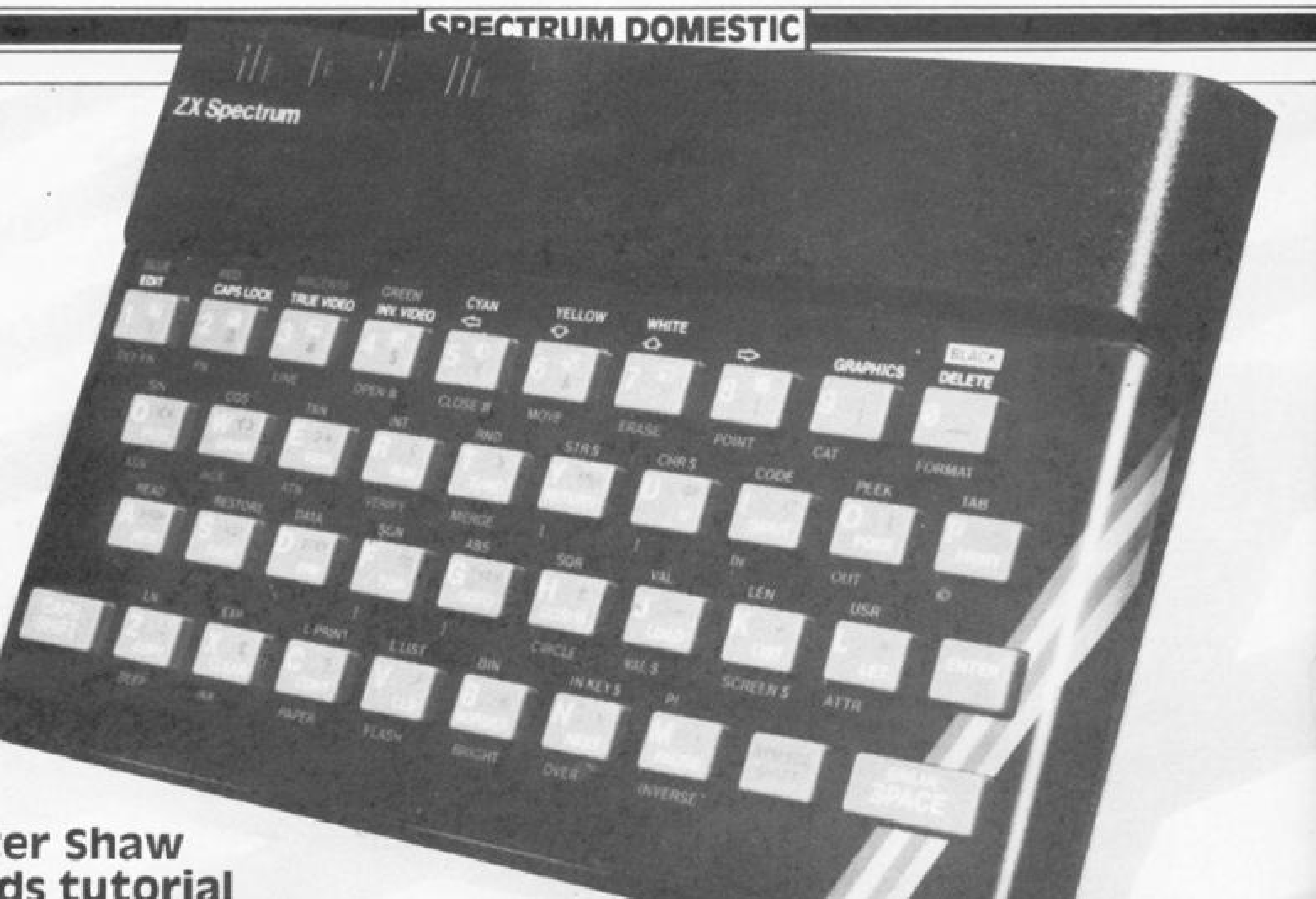
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Peter Shaw holds tutorial on the subject of graphics on the ZX Spectrum. Pull up a chair, plug in your computer and read on . . .

Drawing on experience

There are a number of different methods to define characters on the Spectrum — some easy to understand, others totally incomprehensible. I saw one very interesting method POKEd, line by line. This is obviously not satisfactory when you have 21 characters to define. You would need 168 lines to POKE everything into the memory — that's lines 10 to 1680 using the conventional spacing system! There has to be a better method than that.

To cut down on the amount of typing we have to do, we can change the way we define our characters. To start with I will deal with the use of BIN. The Sinclair manual suggests that you use BIN when defining but I think this is a very long-winded way of doing it.

A binary number can be thought of as eight on/off switches each with a value; when the switch is on, it takes the value and when the switch is off, it becomes zero. The value of each switch is worked out from a power, ie 6↑2 is six to the power two, or 36.

For example, take a look at the binary number 00110101. The value of BIN 00110101 is 0 + 0 + 32 + 16 + 0 + 4 + 0 + 1 = 53. This can be seen fully illustrated in Fig. 1.

And next . . .

To turn a binary number into decimal all you need remember is the number in the top left-hand corner of the boxes so that you can add the 'on' ones together to get the result. Having converted all your BIN numbers into decimal you can now move onto the next part of this character generation method.

The Sinclair manual suggests you use a FOR . . . NEXT loop of zero to seven for some characters. I also use a FOR . . . NEXT loop, but I use it to cover all the characters to be defined, ie FOR A=USR "a" TO USR "(last character to be defined)" +7. Inside the loop I READ all the decimal values and POKE them into the variable 'a'.

```
10  FOR A=USR "a" TO
    USR "a"+7 : REM this
    will require eight
    numbers in DATA
    statements
20  READ user: POKE a,
    user
30  NEXT A
40  DATA 255,0,255,0,
    255,0,255,0
```

Try this program above. As you can see, the FOR . . . NEXT loop can be anything from one to 21 characters long. The DATA statement at the end contains the eight numbers required to create a striped character.

At the bar

Enough said about user-definable graphics — what about programs which demonstrate high resolution graphics on the Spectrum? Well, first up is a 3D Histogram program, which although not really very useful in any practical way, is a good demonstration of colour and Hi-res in action. The program surprisingly only uses two UGD characters, which have been POKEd in using the method shown previously.

Quick on the draw

Once you've tried the Histogram program, you can move onto the next program, Sketch, which is a very sophisticated sketchpad.

The controls you'll need to operate this program are:

F — Flashing cursor.
N — Draw mode cursor.
D — Draw a line.
M — Move cursor.
S — Save screen$.
V — CLS.
C — Circle.
O — Change INK colour.
P — Change PAPER colour.
B — Change BORDER colour.
I — Help.

Fig. 1. An illustration to show that a binary number can be thought of as eight on/off switches.

2↑7	2↑6	2↑5	2↑4	2↑3	2↑2	2↑1	2↑0
128	64		16	8	4	2	1
0 (OFF)	0 (OFF)	1 (ON)	1 (ON)	0 (OFF)	1 (ON)	0 (OFF)	1 (ON)
0	0	2↑5	2↑4	0	2↑2	0	2↑0

```
 30 GO SUB 9000
 40 GO SUB 8000
 50 GO SUB 7000
 60 LET d=1
 70 FOR a=10 TO 0 STEP -1
 80 PRINT AT d,0;a
 90 LET d=d+2
100 NEXT a
130 INPUT "How many Inputs (Max
25) ";i: IF i>25 THEN GO TO 130
135 IF i<14 THEN LET p=2
136 IF i>=14 THEN LET p=1
140 FOR a=4-(1 AND p=1) TO ((i-
1)*p)+4-(1 AND p=1) STEP p
150 INPUT "Input ";(INT (a-2)/p
),h
155 IF h>10 THEN GO TO 150
160 LET h1=(h*2)-1
165 PRINT AT 21,e, INK 0; PAPER
4;"A"; PAPER 2;"B"
170 FOR b=20 TO 21-(h1+1) STEP
-1
180 PRINT AT b,a; INK 4; PAPER
6;"A"; INK 2;"B"
190 PRINT AT b,a; PAPER 4;" ";
PAPER 2;" "
200 NEXT b
210 PRINT AT b,a; PAPER 8; INK
6;"BA"
220 LET b=b+1
230 PRINT AT b,a; INK 4; PAPER
6;"A"; INK 2;"B"
240 NEXT a
250 INPUT "Press ENTER for anot
her run "; LINE a$: RUN
6990 STOP
7000 PLOT 24,175: DRAW 0,-175
7010 PRINT AT 0,0; PAPER 1;"Y"
7020 PRINT AT 21,31; PAPER 1;"X"
7040 RETURN
8000 BORDER 0: PAPER 0: INK 9: C
LS
8010 LET x=0
8020 RETURN
9000 FOR a=USR "a" TO USR "b"+7
9010 READ user: POKE a,user
9020 NEXT a: RETURN
9030 DATA 128,192,224,240,248,25
2,254,255
9040 DATA 1,3,7,15,31,63,127,255
```

The 3D Histogram program.

```
 30 LET x=0: LET y=0
 40 POKE 23658,8: LET f=0
 50 GO SUB 5000: PAUSE 0: GO SU
B 5000
 60 LET a$=INKEY$
 70 LET x=x+(a$="8" OR a$="I" O
R a$="K")-(a$="6" OR a$="Y" OR a
$="H")
 80 LET y=y+(a$="7" OR a$="6" O
R a$="8")-(a$="K" OR a$="H" OR a
$="J")
 90 IF IN 65022=247 THEN LET f=
1
100 IF IN 32766=247 THEN LET f=
0
110 IF IN 65022=251 THEN GO SUB
1000
120 IF IN 32766=251 THEN GO SUB
1500
130 IF IN 65022=253 THEN SAVE "
Screen"SCREEN$
140 IF IN 57342=253 THEN GO SUB
2000
150 IF IN 57342=254 THEN GO SUB
2500
160 IF IN 65278=239 THEN CLS
170 IF IN 65278=247 THEN GO SUB
3000
180 IF IN 63486=254 THEN GO SUB
5000: PAUSE 0: PAUSE 0: GO SUB
5000
190 IF IN 32766=239 THEN GO SUB
3400
230 PLOT OVER f;x,y
240 PLOT OVER f;x,y
250 GO TO 60
1000 REM DRAW
1010 INPUT "Input co-ordinates "
;x1;",";y1
1020 DRAW x1-x,y1-y
1030 LET x=x1: LET y=y1
1040 RETURN
1500 REM MOVE
1510 INPUT "Input co-ordinates "
;x1;",";y1
1520 LET x=x1: LET y=y1
1530 RETURN
2000 REM INK
2010 INPUT "Input new INK colour
";in
2020 INK in
2030 RETURN
2500 REM PAPER
2510 INPUT "Input new PAPER colo
ur ";pa
2520 PAPER pa
2530 DIM p?(1,704)
2540 PRINT AT 0,0; OVER 1; INK 8
;p$(1)
2550 RETURN
3000 REM CIRCLE
3010 INPUT "CIRCLE (x,y,r) x=";x
1;",y=";y1;",r=";r
3020 CIRCLE x1,y1,r
3030 RETURN
3500 REM BORDER
3510 INPUT "Input new BORDER col
our ";bo
3520 BORDER bo
3521 BEEP .5,0
3530 RETURN
5000 BEEP .5,0
5010 OVER 1
5020 PRINT AT 0,0;"MENU"
5030 PRINT "CONTROL KEYS (INCLUD
ING          DIAGONALS)"
5040 PRINT " 6  7  8
            ▛  ▀  ▜

           Y▌     ▐I

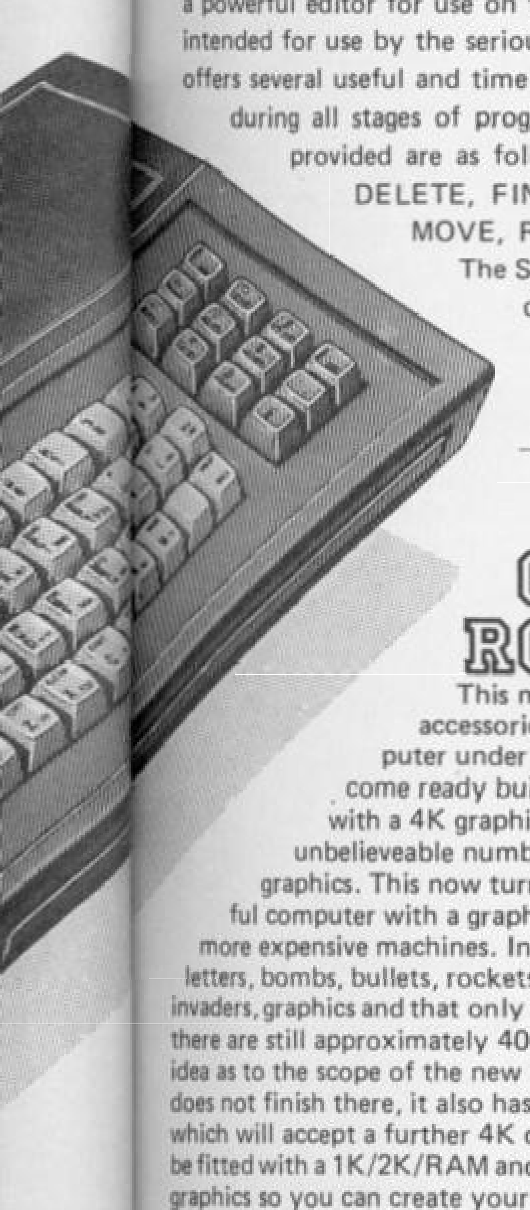
            ▙  ▄  ▟
           H  J  K"
5050 PRINT '"F - FLASHING CURSOR
"
5060 PRINT "N - DRAW MODE CURSOR
"
5070 PRINT "D - LINE DRAWN TO IN
PUT CO-ORDS."
5080 PRINT "M - MOVE CURSOR TO I
NPUT CO-ORDS"
5090 PRINT "S - SAVE SCREEN$"
5100 PRINT "V - CLS"
5110 PRINT "C - CIRCLE"
5120 PRINT "O - CHANGE INK"
5130 PRINT "P - CHANGE PAPER"
5140 PRINT "B - CHANGE BORDER"
5145 PRINT "1 - HELP (THESE INST
RUCTIONS"
5150 OVER 0
5160 RETURN
```

Peter's sophisticated Sketch program.

ZX 80/81 SPECTRUM HARDWARE

SPECTRUM/81 TOOLKIT BOTH AT ONLY £6.95

This is the toolkit which won acclaim in the feature in the August 1982 issue of Sinclair User. "It is the most impressive programm, fast in execution with clear and full instructions . ... it stands out from the rest of the field". The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER, AND VERIFY. The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K Spectrum.



4K GRAPHICS ROM £24.95

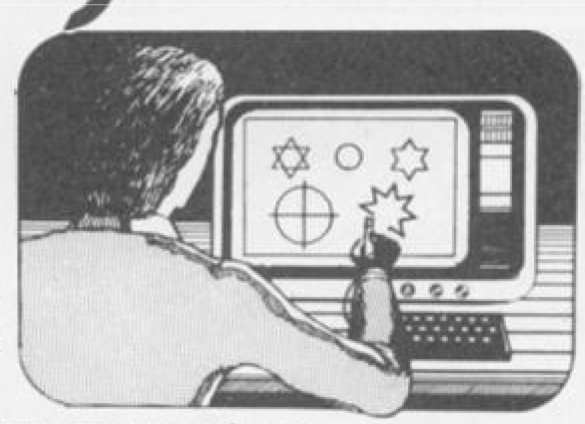
This module unlike most other accessories fits neatly inside your computer under the keyboard. The module come ready built fully tested and complete with a 4K graphic ROM.This will give you an unbelieveable number of extra pre-programmed graphics. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders, graphics and that only accounts for about 50 of them, there are still approximately 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

SPECTRA-SOUND

The so called speaker in your Spectrum is really only a 'buzzer'. With the DK Tronics "SPECTRA SOUND" you can generate fully amplified sound through the speaker on your T.V. set. SPECTRA-SOUND is a very simple but highly effective add-on. This means that you no longer have a faint beep but a highly amplified sound, which can be adjusted with the TV volume control.

The SPECTRA SOUND fits compactly and neatly inside the Spectrum case and is connected by three small crocodile clips. **NEW AT ONLY £9.95**

£19.95 Light Pen



LIGHT PEN

The pen enables you to produce high resolution drawings on your own T.V. screen. The controlling software supplied with the light pen has 16 pre-defined instructions. These are chosen from a menu positioned at the bottom of the screen next to the pen.

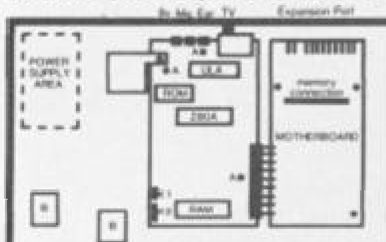
You can utilise the menu for changing colour (Border, Paper, Ink). Drawing circles, arcs, boxes, lines. You are also able to fill any object with any colour, and insert text onto the screen at any chosen place. Of course you can also draw freehand. There is a feature to retain the screens and animate. On the 48K Spectrum you can retain 5 screens.

You can also use the machine code on it's own in your own programs, for selecting out of a menu etc. The software provided will return with the X,Y, cords for it's position on the screen.

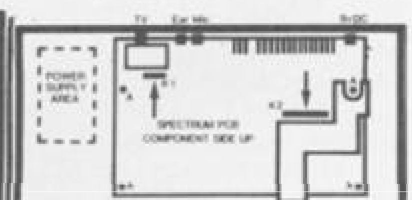
The light pen is supplied with a control interface in order to adjust the sensitivity/pen alignment.

This simply plugs into the ear socket on your spectrum.

Should you require further details please send a S.A.E.



Internal fixing for ZX 81 keyboard case.



Internal fixing for spectrum keyboard case.

Please state type of machine, which ROM memory size, quantity, and place when ordering.

Please send me . . . . @ £ . . . .

Please send me . . . . @ £ . . . .

Please send me . . . . @ £ . . . .

Please add on £1.25 for p/p

I enclose cheque/P.O. payable to DK Tronics total £. . . . .

or debit by Access/Barclaycard No. . . . .

Signature. . . . .

Name . . . .

Address. . . . .

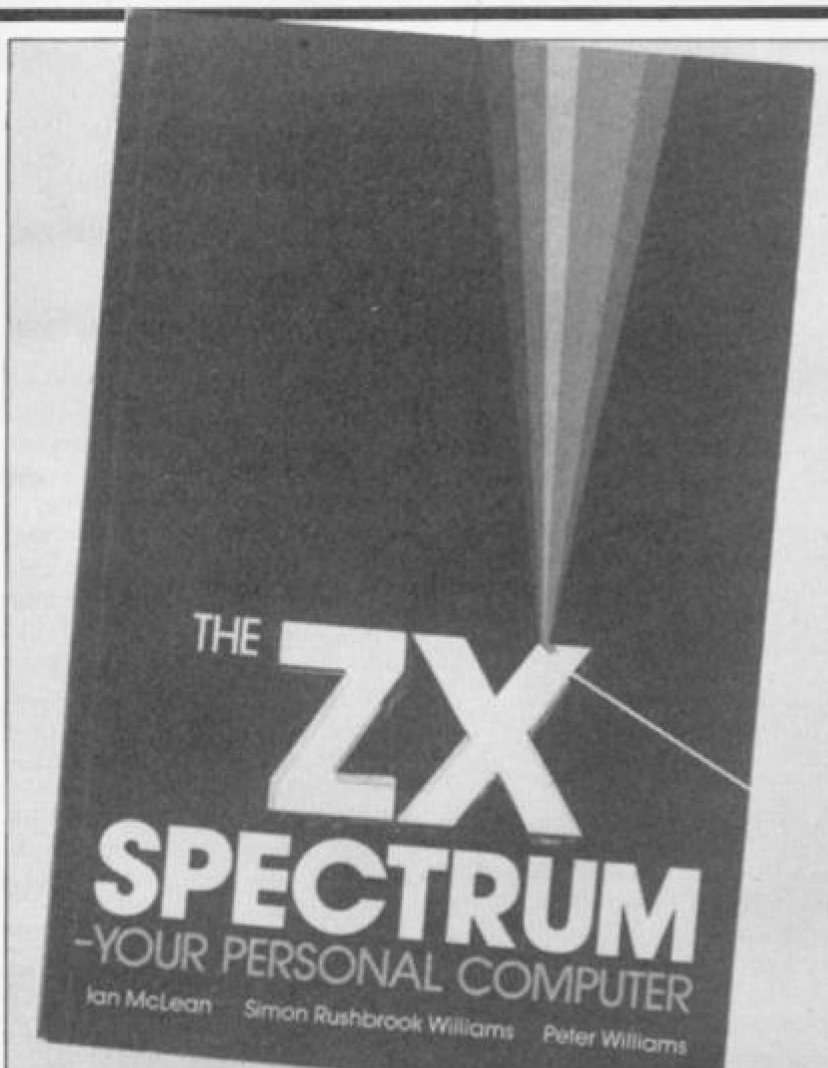
. . . .

Send to DK Tronics, Unit 2, Shire Hill Ind Est, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 26350 (24 hrs) 5 lines.

Bookshelf

Our resident book reviewer, Patrick Cain, examines three new titles for your Sinclair computer.

The ZX Spectrum – Your Personal Computer – Ian McLean, Simon Rushbrook Williams and Peter Williams



'The ZX Spectrum – Your Personal Computer' is a departure from the 'norm' of computer books, and one which fills an area so often ignored, that of the newcomer to computing. The authors Ian McLean, Simon Rushbrook Williams and Peter Williams, all members of the Micro Electronics Educational Development Centre, Paisley College, Scotland, have identified the difficulties that often beset the first time user. Personal computing is not the preserve of 'a special elite of geniuses' as many other books appear to assume and if you've all but gone blue in the face PEEKing and POKEing and getting nowhere then this may be the book you need.

From pages one to 216, the text is lighthearted and entertaining. In eleven chapters it covers what the computer can do, how to use the keyboard, loading and saving programs through to files and data handling, and if you're unsure how the pieces which comprise a full unit are assembled or how to wire the plug it covers that too. Any learning process is always easier if it's enjoyable and while the scope of the book is not far reaching it is neither elementary – rather it assumes no previous knowledge and moves from this most elementary stage to clearly cover all that is necessary to write well written programs in a most enjoyable fashion.

Before the software came the hardware and before any worthwhile software is written it is essential to have a good working knowledge of the bits and pieces. Chapters one to three look at how to get the apparatus up and working properly; saving to and loading from tape, verifying at each stage that what you wanted to do has been done; exploring the keyboard and what each button does – each step is discussed in a clear but uncomplicated way and accompanied by diagrams. At no point are you likely to get the feeling that tells you the next move is the one which will ruin your new investment.

With new-found confidence, tackle chapter five, and see what the Sinclair ROM (by this time you'll know exactly what that is) has provided to enhance the programs you'll soon be writing. The graphic attributes BORDER, PAPER, INK, etc, are all put through their paces. The PRINT statement is introduced and tested. But where the going gets heavy, schematic diagrams and flow charts accompany the text to illustrate what is being discussed. Again, as in the previous chapters, each point is detailed with examples to test the theory.

Computer programs are a series of logical steps, but the trouble is that people tend not to be too logical. Chapter six, 'Making Decisions', deals with the language of the Spectrum. The BASIC commands are introduced (again the approach is a 'suck it and see' style) the sense of each command, or sets of commands, being borne out by the examples which are given. Building from what has gone before, the scope of each command is investigated, reinforcing and confirming the earlier theory, cross-referencing the manual and explaining clearly what the manual often assumes. Here, as throughout, the various sections open with a listing and definition of each of the language elements to be discussed and concludes with a summary of what has been covered.

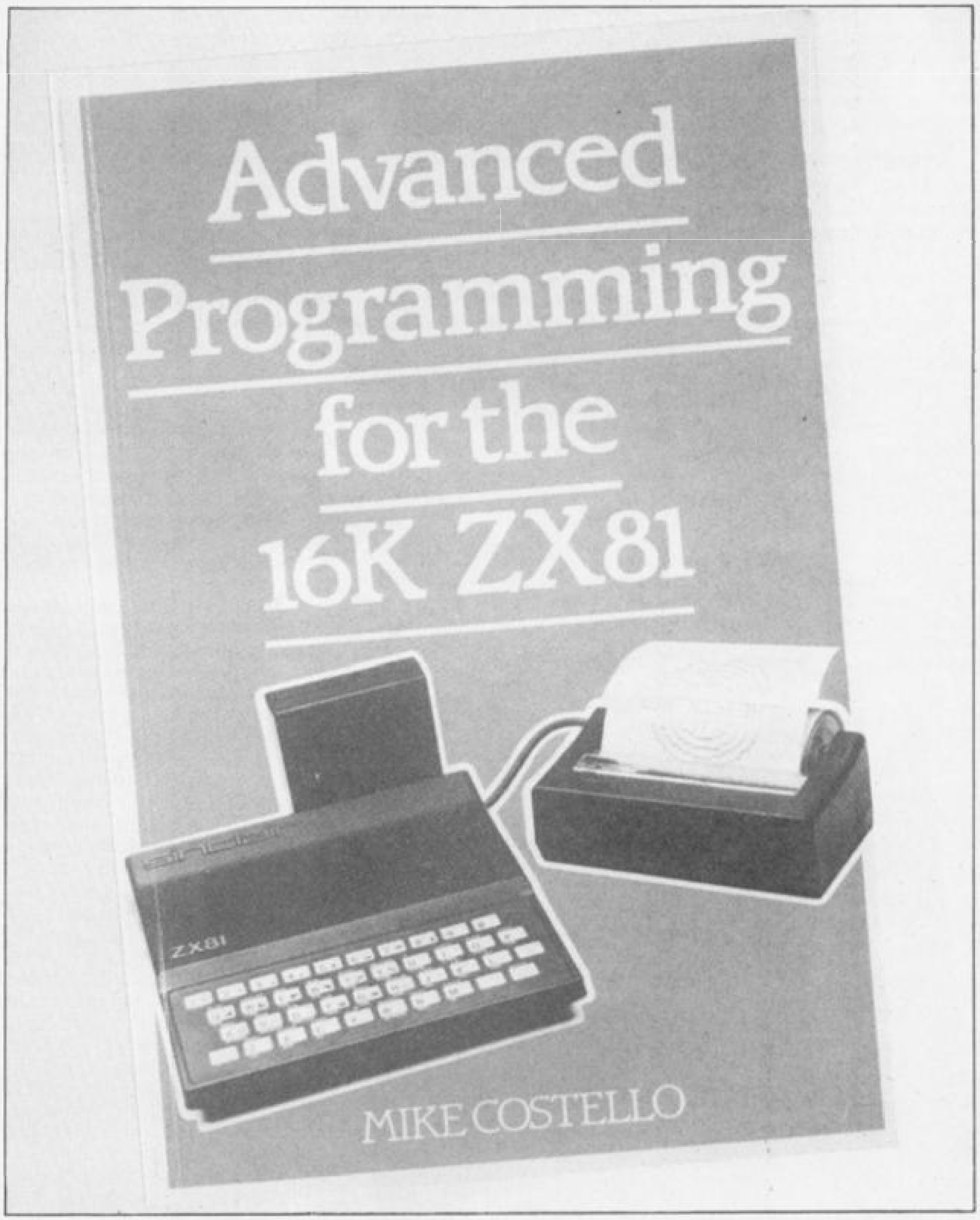
In chapter seven, 'Words and Numbers', a study of data manipulation statements, LEN, VAL, STR$, ABS, etc, discusses the finer points of Spectrum BASIC. Commands which might otherwise have gone unused through a lack of understanding, but ones that are none the less inherent in any accomplished program, are clarified with reasons for their use and helpful examples.

With equal commitment to ease of understanding and clarity, the remaining chapters examine the sound and grpahics capabilities on the Spectrum. Worthy of special note is chapter ten, 'Files and Data Handling'. This is perhaps a difficult area to grasp for anyone not familiar with the sizeable amounts of data, but again the treatment is such that the complexities of the problem are greatly diminished.

Throughout, the standard of 'The ZX Spectrum – Your Personal Computer' is high. A good foundation is an essential part of any advanced programming endeavour. On completion of this book it is likely that you will move with ease to higher level books; certainly your command of BASIC should enable you to write good quality programs encompassing all of the features of Spectrum BASIC.

'The ZX Spectrum – Your Personal Computer' is written by Ian McLean, Simon Rushbrook Williams and Peter Williams, and published by Prentice/Hall International and is excellent value at £5.95. ISBN 0 13 985028 7.

Advanced Programming for the ZX81 – Mike Costello



The ZX81 is a good computer. Obviously its capabilities are restricted by price and size, but its abilities are great. Its potential greatness though may never be realised as the challenge of highly impressive, similarly priced machines is not too far off. The weakness which will prevent the ZX81 staying off the challenge is not an on-board deficiency but improper development of realistic software. This is the opinion of Mike Costello, author of 'Advanced Programming for the ZX81', an opinion which has much to justify it.

As author of several papers and programs for microcomputers and owner of a business publishing microcomputer software and magazines, Mr. Costello is ably suited to voice such opinions. Does then his book, 'Advanced Programming for the ZX81' offer any real alternative or redirection?

Obviously any advanced level of programming on a machine with as limited a level of BASIC as that possible with the Z80A microprocessor requires the employment of direct programming in assembly language. Realising that this is true, there are three chapters dealing specifically with machine code implementation. The previous six chapters look at how, with thought and ingenuity, the BASIC that is available may be used more effectively.

Before going any further it has to be said that from page one through the subsequent 126 pages it is assumed that the reader has already gained and developed his or her skills in BASIC programming and has some elementary knowledge of the workings of the machine beyond BASIC.

Two of the main drawbacks of the ZX81 are its restrictive available memory and its speed. Chapter one takes these two problems to task. By examing how and why there is an excessive use of memory and by offering suggestions as to how the call of the operating system upon the memory can be reduced. Following these suggestions will realise much greater potential of the 16K RAM. Techniques too, to increase the inhibitive speed of the ZX81 will significantly increase the expectancy of the machine. Those techniques suggested do not call for anything too elaborate but merely point to methods that professional programmers use; each is simply described and detailed clearly enough to ensure that a good understanding of them is possible after only a few applications.

Many other books of this ilk make great play of BASIC routines – short programs which allow the programmer to achieve more elaborate effects or 'fill-in' for deficiencies of the ZX81's version of BASIC. Often though these are self-defeating, demanding too much memory to allow useful subsequent programming. Thankfully those included in chapter two are not guilty of this.

One of those aspects of BASIC which is deficient on the ZX81 is input. The best of programs can come to grief at the hands of a novice operator. Where it is not possible to prompt the correct type of answer by arranging for text to be displayed on the screen before the awaitning cursor, as in the ZX81, the likelihood of computer slaughter is even greater. To overcome this drawback a small 30 line subroutine is listed, implement this and 'Hey Presto!' suddenly you're in command not only specifying where on the screen the input should go but also what type of input. To 'kill the cat' each line of the apparent magic is explained.

Similarly, the output capabilities of the ZX81 leave a lot to be desired. It is not possible to specify the format of numeric or string data using only those facilities on-board. Business applications on other machines have a statement 'PRINT USING' which allows the programmer to pre-define the number of decimal digits either side of a point or to select any substring from a string. Such a facility would greatly enhance the screen output of any data. Again in the absence of such a tool, Mike Costello shows how a subroutine, PRINT USING, can be simulated. While he is cer-

tainly not the first to think of such a thing, the strength of his subroutines is that it does what is necessary and still leaves sufficient memory available for worthwhile programming.

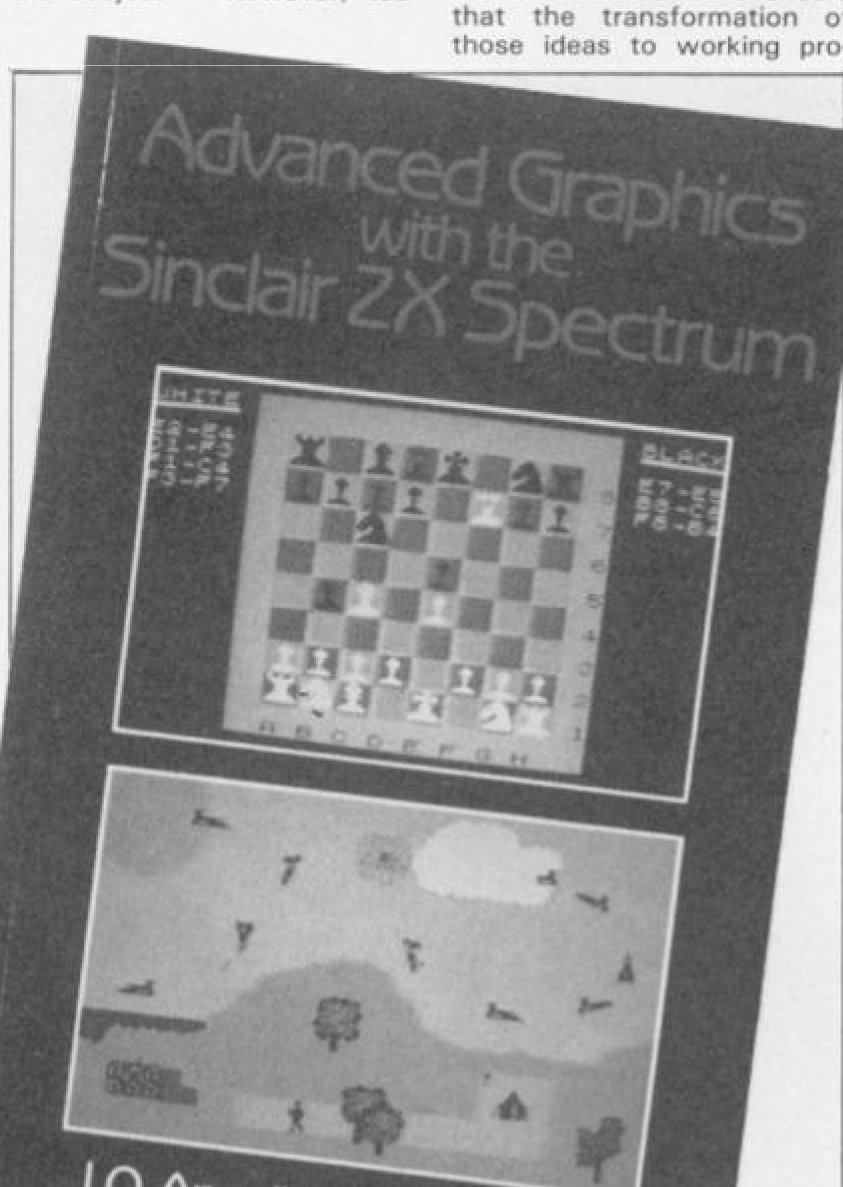
A subroutine to simulate the READ DATA statement completes the chapter. Like the previous two utilities it is effective, powerful and an obvious aid to writing better software.

Chapter four deals with 'Supergraphics' making the screen do things the way professional programmers do. However, nothing here falls into the innovative software category. The animation and screen drawing areas are fairly well trodden ground in such books and in many they receive far better treatment.

Any serious real attempt of 'real' programming on the ZX81 must have a study of the computers assembly language. Many books are available on the subject – however, too often they tend to leave the reader even more confused than ever. The cursory handling of the matter in three chapters in this book is sufficient to guide someone with some previous knowledge through application of assembly language subroutines to some achievable level of understanding. Starting with a discussion of the topic in chapter seven 'Using Assembly Language on the ZX81', the text moves on to finally offer and examine full assembly language application programs. The topic is clearly and logically discussed and an improvement on the quality of software you write, and hence the use to which you put your computer, should be evident.

Throughout, I am unconvinced that 'Advanced Programming for the 16K ZX81' realises its goal to produce better software, that will only come from the imagination of those who programme. What it does achieve is to ensure that the transformation of those ideas to working programs will not be restricted by shortcomings of the system.

'Advanced Programming for the 16K ZX81' priced at £5.95, is written by Mike Costello and published by Macmillan Press. ISBN 0333 34 5908.



Advanced Graphics with the Sinclair ZX Spectrum – I O Angell and B J Jones

'Advanced Graphics with the Sinclair ZX Spectrum' should on successful completion enable the reader to produce screen displays on par with anything available commercially.

Now for the bad news. Such ability is not easily gained and to understand the text fully a good deal of previous knowledge is necessary. The authors, both members of the Department of Computer Science, University of London, are undoubtedly well qualified to instruct on computer graphics and their work has produced an almost complete text book for the subject.

It is intended, according to the introduction, that the book may be read on different levels – either to simply gain from it the graphic displays provided by the listings therein, or to understand how those displays have been produced and then be capable of equivalent ingenuity. I would suggest that the cost of £9.95 would be prohibitive if your intention is only to realise the former.

By understanding the text the reader on completion will understand the theory and techniques of producing pie charts, bar charts, geometric drawings, engineering drawings and arcade type video games. Before undertaking study of the book the reader should have a good working knowledge of BASIC and some knowledge of machine code. No knowledge of graphics at any level is necessary, the authors rightly feel that any knowledge of graphics necessary will be given in the book. Further it is recommended that readers should be familiar with cartesian coordinates. I would suggest that a knowledge of geometry and algebra beyond this will be required in order that the reader may concentrate on the graphics theory content rather than the mathematics.

Throughout the discussion it is assumed that a 48K is being used, although an appendix does give notes on how and where to make alterations should a 16K version be used. The approach has been to accompany each piece of theory with a worked example, similar to the method of maths or physics books. Where problems are likely to become over-complex or involve a modular approach has been adopted, breaking each larger work area into smaller more readily understandable ones. Without doubt this is effective, allowing the reader to progress at his or her own pace and to move forward when the reader feels he or she has mastered what has gone before. In this way no body of work ever seems inconquerable.

Chapter one looks at those commands which are concerned with graphics. I hope I won't be accused of shrinking from my task if I say that the following chapters analyse and explore what can be achieved by implementing these commands and their mathematical and computing aspects. Significant graphic displays will not be possible without an understanding of the mathematics used to generate them. It should be understood then that the maths can get heavy. It is the nature of any advanced study to be beyond the scope of one book where, in order to keep this book to a finite size, it has been necessary to restrict a discussion; however, further reading has been recommended.

Chapter fourteen, by way of a conclusion, looks at a practical video game and, with reference to what has gone before, examines it to discover how it was constructed. Chapter fifteen points to how this newly acquired skill and knowledge can be put to use by suggesting some major graphics projects; by this stage they should be within the ability of the reader.

The book aims at truly 'advanced' graphics in design and implementation and thus it does require a serious study and degree of commitment. The rewards it will pay are high.

Advanced Graphics with the Sinclair ZX Spectrum is written by IO Angell and BJ Jones. It is published by Macmillan Press and costs £9.95. ISBN 0 333 35050 2.

Earthattack

With just a sprinkling of machine code, David Mold of Cheshunt has devised an exciting space adventure for your ZX Spectrum.



Written for the 16K and 48K Spectrum, this listing presents you with an exciting game which makes great use of machine code to save vital memory space. This program is divided into four main sections. These are:

1) Lines 1 to 180 contain all the initialisation and jumps to the user-defined graphics and machine code initialising routines. Since the amount of initialisation which needs to be done in this program is very large, there is quite a long pause after RUNning before the action starts — however, I shall explain later how this problem can be overcome.
2) Lines 200 to 999 contain the main game loop, including its servant subroutines (scoring, 'smart bomb' and high score routines). This loop calls all the machine code routines, and ties together their responses and any other relevant BASIC needed for the 'action' of the game.
3) Lines 1000 to 2400 contain the data and POKEing routines to set up first the user-defined graphics, then the machine code.
4) Lines 3000 to 3250 contain the three pages of instructions and game details which the computer cycles through between games.

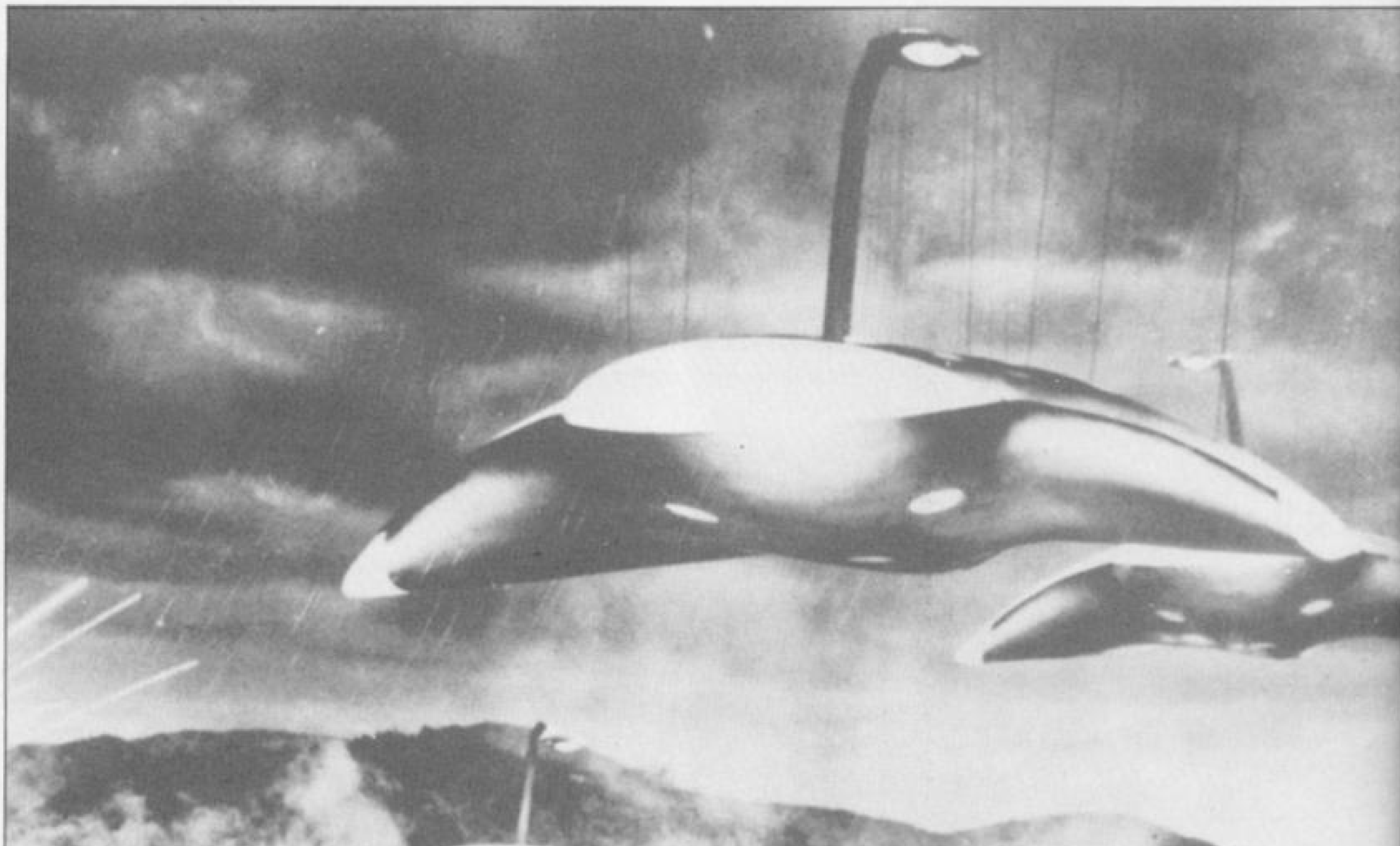
The capital letters in quotes in the following lines should be entered in the Graphics mode, and when the program is RUN, produce the corresponding user-defined graphics to that key:

140, 180, 200, 230, 245, 701, 715, 725, 3140.

Variables

The variables used, in order of their appearance, are:

s$	— Initials of the highest scorer.
h$	— The high score total.
s	— Current score.
bo	— INT s/1000 — used in calculating bonus bombs.
n	— Used throughout the program as a control variable in FOR . . . NEXT loops.
a$	— Displays the number of ships remaining



(initially four).

l — Number of laser shots.

sb — The number of smart bombs ready for use.

x and y — The co-ordinates of the ship.

p — The screen byte directly in front of the ship (top byte of the character position).

rg — The random variable used in selecting alien types.

b — The variable used for POKEing into machine code (address 32477) to denote the height of the next building.

a — The dummy variable for jumps to machine code.

p$ — Used in the high score routine to accept initials.

There are numerous other variables used in the program, but they are mostly control or dummy variables which are only used once and their use is fairly self-explanatory.

Welcome to the machine

There are three main machine code routines used in the program. The data for them starts at line 2000, and I have disassembled them for you in Figs. 3a, 4a and 4b.

First is the 'SMART BOMB' routine. This is 26 bytes long, and starts at address 32400. Using the attributes file of the Spectrum display, it changes the PAPER colour of every character position in the central third of the display (the part which the 'action' of this game utilises) to red. Whilst doing this it also calculates how many of

the character positions previously contained yellow as their INK colour. This is the number which it returns to the variable, s, when it returns to BASIC, which is then multiplied by 10 to increase your score according to how many aliens your smart bomb destroyed.

Next comes the 'SIDE SCROLL' and 'BUILD CITY' routines, which actually run together, and are called by USR 32426. The height that the skyscrapers are built up to depends upon the variable, b, which is POKEd into location 32477. The routine operates once again only on the central third of the display. The reasons for this are:

1) This is in keeping with the character of the game,
2) it speeds up the workings of code which has to operate on the thousands of bytes in the Spectrum's D_File, and
3) due to what is termed the curious construction of the display file, it makes manipulating one third of the screen at a time a fairly simple task, but crossing between the thirds rather complicated.

The last of these three main routines is the 'CHECK FIRING' routine. Actually it does rather more than its name suggests. Its action is as follows.

First the laser fire of the ship is drawn. At each step of this a check is made to see whether an alien has been hit or not.

If an alien has been hit, it checks whether this is a saucer or a monster, and adjusts the value of bc accordingly. It then creates a two stage explosion.

The routine then erases the laser fire, and returns to BASIC.

In short . . .

There are two other shorter machine code routines also included. The routine which starts at address 32350 and shown in Fig. 3b is a servant subroutine for the 'CHECK FIRING' code. When called from within another routine, it prints a character to the screen by POKEing the eight bytes which follow the call instruction to the character position, the start of which is specified by HL.

The routine starting at address 32300 produces the display of the city being destroyed at the end of the program, and is disassembled in Fig. 3c.

I mentioned before, the delay caused by the setting up of the machine code and user-defined graphics. Another problem with all this data is that it is an incredible waste of space, since once it has all been POKEd into the relevent addresses when the program was first run, it justs sits there cluttering up your machine. And since the program as it stands uses very nearly all the space in a 16K machine, this means that, should you be tempted, you would find it hard to squeeze in many more lines before the Spectrum gives up the ghost.

The answer is, of course, to SAVE the code and user-defined graphics in a separate file on tape, and re-LOAD them each time you LOAD the program from tape. This is a very quick efficient method which really makes use of the space saving advantages which machine code can offer.

So, once your program has been typed in and you have RUN it once or twice to ensure that there are no errors in your typed-in version, you can erase every program line between 1000 and 2400 inclusive. Then type in the program lines shown in Fig. 1. Do not worry that some of these lines overwrite program lines that still exist — this is intended.

Now, find some room on a cassette somewhere, and SAVE the program and the two code files by typing:

RUN 2000

When re-LOADed, the program will automatically LOAD the two files and then RUN itself.

Time for fun!

And now, after all this effort, for the fun part — playing the game! Fig. 2 shows the keys used to control your rocket ship as it wings its way over a terrestrial cityscape. To add amusement there are a whole crop of little alien saucers out to get you. Although they don't actually shoot at you, there is a plentiful supply of them, and you can be destroyed in any of three ways: by crashing into them, by crashing into the city below you, or by accidentally moving into 'hyperspace' above. In fact, your little ship is not very sturdy at all, but you do have one weapon on your side — your lasers!

To start with you have 20 lasers, and your laser count is decremented by one each time you use them. You score 10 points for each saucer you hit, and 20 for each alien being (little yellow 'nasties' who stand on rooftops and are very hard to hit). Each time you bring the nose of your ship into contact with a green fuel base, your number of lasers is incremented by 20. It does not matter if you plough right through these fuel bases.

You get three smart bombs per 1,000 points scored. While the little bomb graphics are still showing beneath the city, each time you press the Space key the sky will turn red, and all visible aliens will be wiped out, and you will be given 10 points for each. Your ship will then accelerate out of the dangerous area.

The game ends when all five of your ships have been destroyed.

Fig. 1.

```
  30 LOAD "mcode"CODE
  40 LOAD "chars"CODE USR "a"
2000 SAVE "attack" LINE 2050
2010 SAVE "mcode"CODE 32300,300
2020 SAVE "chars"CODE USR "a",6*
8
2030 PRINT "SAVEing finished": S
TOP
2050 RUN
```

Fig. 2.

```
          EARTH ATTACK

Use Keys:
          1-5......Up

          Q-T......Down

          6-0......Fire

          SHIFT....Extra Speed

          SPACE....Smart bombs

PRESS 'S' TO START
```

Fig. 3a. 'SMART BOMB' disassembled.

```
        ld hl,ATTR FILE
        ld c,0
        ld b,255
LOOP    inc hl
        ld a,hl
        cp 6
        jrnz CHANGE
        inc c
        ld a,8
        ld (hl),a
        djnz LOOP
        ret
CHANGE  add a,16
        ld (hl),a
        djnz LOOP
        ret
```

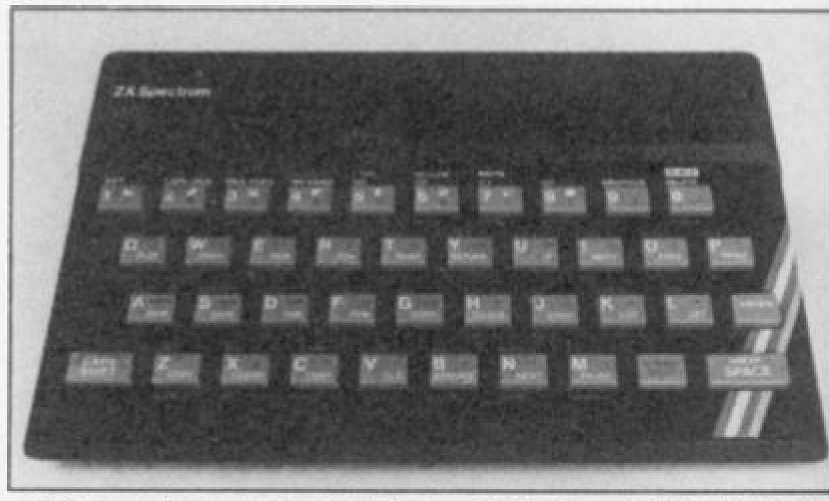
Fig. 3b. 'CPOKE' disassembled.

```
        ld b,8
LOOP    pop de
        ld a,(de)
        inc de
        push de
        ld (hl),a
        ld de,256
        add hl,de
        djnz LOOP
        ret
```

Fig. 3c. End of game display disassembled.

```
        ld a,7
LOOP2   ld hl,ATTR FILE
        ld b,255
LOOP1   ld (hl),a
        inc hl
        djnz LOOP1
        halt
        dec a
        jrnz LOOP2
        ld b,l
LOOP5   ld hl,D FILE
LOOP4   ld c,32
        xor a
LOOP3   ld a,(hl)
        srl a
        ld (hl),a
        dec hl
        dec c
        jrnz LOOP3
        ld a,71
        cp h
        jrnz LOOP4
        djnz LOOP5
        ret
```

```
   1 CLEAR 32299
   2 BEEP .5,12: BEEP .5,24
  30 GO SUB 1000
  40 GO SUB 2000
  50 BORDER 0
  55 LET s$="..."
  60 LET hs=0
  65 LET s=0
  70 LET t=0
  80 LET bo=0
  85 GO TO 3000
  99 PAPER 0: INK 7: CLS : FOR n
=0 TO 20: BEEP .005,n: NEXT n
 100 LET x=9: LET y=5: LET b=1
 110 FOR n=0 TO 7: PRINT INK 1;A
T n,0;"████████████████████████
██████": NEXT n
 120 LET s=0
 130 PRINT AT 20,0;"SCORE:";s
 140 LET a$="A A A A ": PRINT AT
 20,15;a$
 150 FOR n=16 TO 19: PRINT AT n,
0; INK 5;"████████████████████
████████████": NEXT n
 160 LET l=20
 165 PRINT AT 0,0;"LASERS:";l;"
"
 170 PRINT AT 0,16;"HI-SCORE:";h
s
 180 PRINT AT 18,15; INK 2; PAPE
R 5;"DDD": LET sb=3
 200 LET x=x+(IN 64510<255)-(IN
63486<255): PRINT AT x,y;"A";
 210 LET p=PEEK (PEEK 23684+256*
PEEK 23685): IF p THEN GO SUB 50
0
 220 IF IN 61438<255 THEN IF l T
HEN GO SUB 400
 230 IF RND>.79 THEN PRINT AT RN
D*5+8,31; INK 6;"B"
 240 IF IN 32766<255 THEN GO SUB
 700
 245 LET rg=RND: IF rg>.96 THEN
PRINT AT 15-b,31; INK 4;("C" AND
 rg>.98)+(CHR$ 16+CHR$ 6+"F" AND
 rg<=.98): BEEP .005,10: BEEP .0
05,20
 255 LET b=INT (RND*3)+1
 260 PRINT AT x,y;" ": POKE 3247
7,b: LET a=USR 32426: IF IN 6527
8<255 THEN LET a=USR 32426
 270 GO TO 200
 400 REM FIRING SUBROUTINE
 405 LET l=l-1
 440 BEEP .005,30: LET a=USR 325
07: IF a THEN BEEP .01,7: BEEP .
01,0: GO TO 450
 442 PRINT AT 0,7;l;" "
 445 RETURN
 450 LET s=s+10*a
 460 PRINT AT 20,6;s;" ";AT 0,7;
l;" "
 470 RETURN
 500 IF p=60 THEN : LET l=l+20:
BEEP .01,20: GO TO 460
 501 BEEP .01,1: BEEP .01,2: BEE
P .01,4: BEEP .01,8: BEEP .01,16
: BEEP .01,8: BEEP .01,4: BEEP .
01,2: BEEP .01,1
 510 PRINT AT x,y; OVER 1;"#": B
EEP .01,0: BEEP .01,-.5: BEEP .0
1,-1
 515 IF a$="!" THEN GO TO 600
 520 LET a$=a$(3 TO ): IF a$=""
THEN LET a$="!"
 530 LET s=s-10: PRINT AT 20,15;
a$;"  "
 550 PRINT AT x,y; INK 1;"█": LE
T a=USR 32426: LET x=9
 560 BEEP .3,0: PRINT AT 20,6;s;
" ": RETURN
 600 PRINT AT 4,10; FLASH 1;"GAM
E OVER": FLASH 0: FOR n=1 TO 8:
LET a=USR 32300: BEEP .1,n: NEXT
 n: PAUSE 2: PAUSE 1: IF hs<s TH
EN LET hs=s: GO SUB 800
 610 GO TO 3000
 620 GO TO 100
 700 LET sb=sb-1
 701 IF INT (s/1000)>bo THEN LET
 sb=3: PRINT AT 18,15; INK 2; PA
PER 5;"DDD"
 702 IF sb<0 THEN RETURN
 710 LET s=s+10*USR 32400: BEEP
.5,7: BEEP .5,0: PRINT AT 20,6;s
;" ": PRINT AT 18,15+sb; INK 5;"
█"
 715 IF INT (s/1000)>bo THEN LET
 sb=3: PRINT AT 18,15; INK 2; PA
PER 5;"DDD"
 716 LET bo=INT (s/1000)
 720 FOR n=0 TO 31: POKE 32477,I
NT (RND*3)+1: LET a=USR 32426
 725 PRINT AT x,y-1; PAPER 8;" A
": BEEP .01,n
 730 NEXT n: RETURN
 800 PAPER 0: INK 6: CLS
 810 PRINT "          EARTH ATTAC
K"
```



```
 820 LET a$="WELL DONE, YOU HAVE
 BEATEN THE  HIGH SCORE: PLEASE
ENTER YOUR   INITIALS NOW"
 830 PRINT '''
 840 FOR n=1 TO LEN a$: PRINT a$
(n);: BEEP .003,0: NEXT n
 850 PRINT ''TAB 5;
 860 LET s$=""
 862 PRINT "---";: FOR n=1 TO 3:
PRINT CHR$ 8;: NEXT n
 865 FOR n=1 TO 3
 866 PRINT "?";
 870 PAUSE 0: LET p$=INKEY$: IF
LEN p$<>1 THEN GO TO 870
 880 PRINT CHR$ 8;p$;: LET s$=s$
+p$
 885 BEEP .1,n
 890 NEXT n
 900 PAUSE 50: RETURN
 999 STOP
1000 FOR n=1 TO 6: READ a$
1010 FOR p=0 TO 7: READ a
1020 POKE USR a$+p,a: NEXT p
1030 NEXT n
1040 DATA "a",BIN 11100000,BIN 1
10000,BIN 11111000,127,127,BIN 1
1111000,BIN 110000,BIN 11100000
1050 DATA "b",BIN 11000,BIN 1001
00,126,129,129,126,0,0
1055 DATA "c",BIN 111100,BIN 100
0010,129,BIN 1000010,60,60,60,60
1056 DATA "d",0,64,BIN 1011100,1
26,126,BIN 1011100,64,0
1057 DATA "e",255,BIN 10011001,B
IN 10011001,255,BIN 10011001,BIN
 10011001,255,255
1058 DATA "f",BIN 1011101,BIN 10
1010,BIN 110110,127,BIN 1010101,
BIN 1010101,BIN 10100,BIN 110110
1060 RETURN
```

```
2000 REM SMART BOMB
2010
2020 DATA 33,255,88,14,0,6,255,3
5,126,254
2030 DATA 6,32,7,12,62,8,119,16,
-12,201
2040 DATA 198,16,119,16,-18,201
2050
2060 REM SIDE SCROLL
2070
2080 DATA 6,64,33,0,72,17,32,0,6
2,0
2090 DATA 119,25,16,252,33,0,89,
6,8,17
2100 DATA 32,0,62,7,119,25,16,-4
,1,0
2110 DATA 8,17,0,72,33,1,72,237,
176,1
2120 DATA 0,1,17,0,89,33,1,89,23
7,176
2130
2140 REM BUILD CITY
2150
2160 DATA 6,0,14,15,62,22,215,12
1,215,62
2170 DATA 31,215,62,16,215,62,5,
215,62,17
2180 DATA 215,62,0,215,62,148,21
5,13,16,-26
2190 DATA 201
2200
2210 REM CHECK FIRING
2220
2230 DATA 14,0,42,132,92,17,0,3,
25,229,6,5,126,254,129,40,16,254
,127,40,11,54,255,35,16,-14,118,
118,118,118,24,47,12,197,237,82
2240 DATA 229,205,94,126
2250 DATA 0,66,36,24,24,36,66,0,
118,118,225
2252 DATA 229,205,94,126,153,90,
16,199,227,8,90,153,118,118,225
2260 DATA 205,94,126,0,0,0,0,0,0
,0
2265 DATA 0,193,12
2266 DATA 225,62,5,54,0,35,4,184
,32,-7,6,0,201
2270
2280 REM [illegible]
2300 FOR n=1 TO 26+50+31+92
2310 READ a: POKE 32399+n,a
2320 NEXT n
2330 DATA 62,7,33,0,89,6,255,119
,35,16,-4,118,61,32,-13,6,1,33,2
55,79,14,32,175,126,203,63,119,4
3,13,32,-5,62,71,166,32,-16,16,-
21,201
2340 FOR n=1 TO 39
2350 READ a: POKE 32299+n,a
2360 NEXT n
2370 DATA 6,8,209,26,19,213,119,
17,0,1,25,16,-11,201
2380 FOR n=1 TO 14
2390 READ a: POKE 32349+n,a: NEX
T n
2400 RETURN
3000 INK 7: PAPER 0: CLS
3010 LET a$=" DAVID MOLD "
3020 FOR n=1 TO LEN a$
3030 PRINT a$(n);
3040 NEXT n
3110 FOR n=0 TO 7: INK n: PRINT
AT 3,9; INK n;"EARTH ATTACK": BE
EP .1,n
3120 PRINT '"Use Keys:"'TAB 9;"1
-5......Up"''TAB 9;"Q-T......Dow
n"''TAB 9;"6-0......Fire"''TAB 9
;"SHIFT....Extra Speed"''TAB 9;"
SPACE....Smart bombs"
3121 PRINT '"PRESS 'S' TO START"
3122 NEXT n
3125 PAUSE 250
3126 IF INKEY$="s" THEN GO TO 99
3127 CLS
3130 PRINT "Earth Attack": PRINT
: PRINT : PRINT
3140 LET a$="B........10 POINTS"
+CHR$ 13+CHR$ 13+"F........20 PO
INTS"+CHR$ 13+CHR$ 13+"C........
REFUELLING Stn"+CHR$ 13+CHR$ 13+
CHR$ 13+"PRESS 'S' TO START"
3150 FOR n=1 TO LEN a$
3160 PRINT a$(n);: BEEP .003,0:
NEXT n
3170 PAUSE 250: IF INKEY$="s" TH
EN GO TO 99
3180 CLS
3190 PRINT "EARTH ATTACK"
3200 PRINT "------------"
3205 PAUSE 50
3210 PRINT '''"HIGH SCORE=";HS:
BEEP .1,10: PAUSE 50
3220 PRINT '"LAST SCORE=";S: BEE
P .1,9: PAUSE 50
3230 PRINT ''"HIGH SCORE BY ";s$
: BEEP .1,8
3235 PRINT '''''"PRESS 'S' TO ST
ART"
3240 PAUSE 200: IF INKEY$="s" TH
EN GO TO 99
3250 GO TO 3000
```

Fig. 4a. 'SIDE SCROLL' disassembled.

```
SIDE SCROLL: ld b,64
             ld hl,D FILE
             ld de,32
             ld a,0
LOOP1        ld (hl),a
             add hl,de
             djnz LOOP1
             ld hl,ATTR FILE
             ld b,8
             ld de,32
             ld a,7
LOOP2        ld (hl),a
             add hl,de
             djnz LOOP2
             ld bc,2048
             ld de,D FILE
             ld hl,D FILE + 1
             ldir
             ld bc 256
             ld de ATTR FILE
             ld hl,ATTR FILE
              + 1
             ldir
BUILD CITY:  ld b,0
             ld c,15
LOOP3        ld a,22
             rst 16
             ld a,c
             rst 16
             ld a,31
             rst 16
             ld a,16
             rst 16
             ld a,5
             rst 16
             ld a,17
             rst 16
             ld a,0
             rst 16
             ld a,148
             rst 16
             dec c
             djnz LOOP3
```

Fig. 4b. 'CHECK FIRING' disassembled.

```
             ld c,0
             ld hl,(DFCC)
             ld de,768
             add hl,de
             push hl
             ld b,5
LOOP1        ld a,(hl)
             cp 129
             jrz X1
             cp 127
             jrz X2
             ld (hl),255
             inc hl
             djnz LOOP1
             halt
             halt
             halt
             halt
             jr X3
X2           inc c
X1           push bc
             sbc hl,de
             push hl
             call CPOKE
             DEFB 0,66,36,
             24,24,36,66,0
             halt
             halt
             pop hl
             push hl
             call CPOKE
             DEFB 153,90,
             16,199,227,8,
             90,153
             halt
             halt
             pop hl
             call CPOKE
             DEFB 0,0,0,0,
             0,0,0,0
             pop bc
             inc c
X3           pop hl
             ld a,5
LOOP2        ld (hl),0
             inc hl
             inc b
             cp b
             jrnz LOOP2
             ld b,0
             ret
```

The 1K corral

A galaxy of great programs rounded up for your 1K ZX81.

Although sometimes frustrating to work with the limited confines of 1K of memory, you may find it worthwhile to study how programmers have managed to use the memory space — something you may (and should) find useful even when working within 16K or 48K.

If you would like to contribute material to this feature, please try to explain the techniques you have employed to get your program into 1K. And now, on with the show . . .

Space attack
Anthony Dibble

The object of this game is to avoid the aliens which appear on the screen. You are the Graphic H and the aliens are represented by inverse Xs. Your controls for the game are 'Z' to move left and 'M' to move right.

At the beginning of the game, you are positioned on the screen which is black, thus making it very easy for you to see yourself. However, after you have managed to reach a score of 500 points, the background changes to Graphics Rs and the game obviously becomes more difficult.

When you hit an alien, the screen displays an explosion and your score.

Variables used

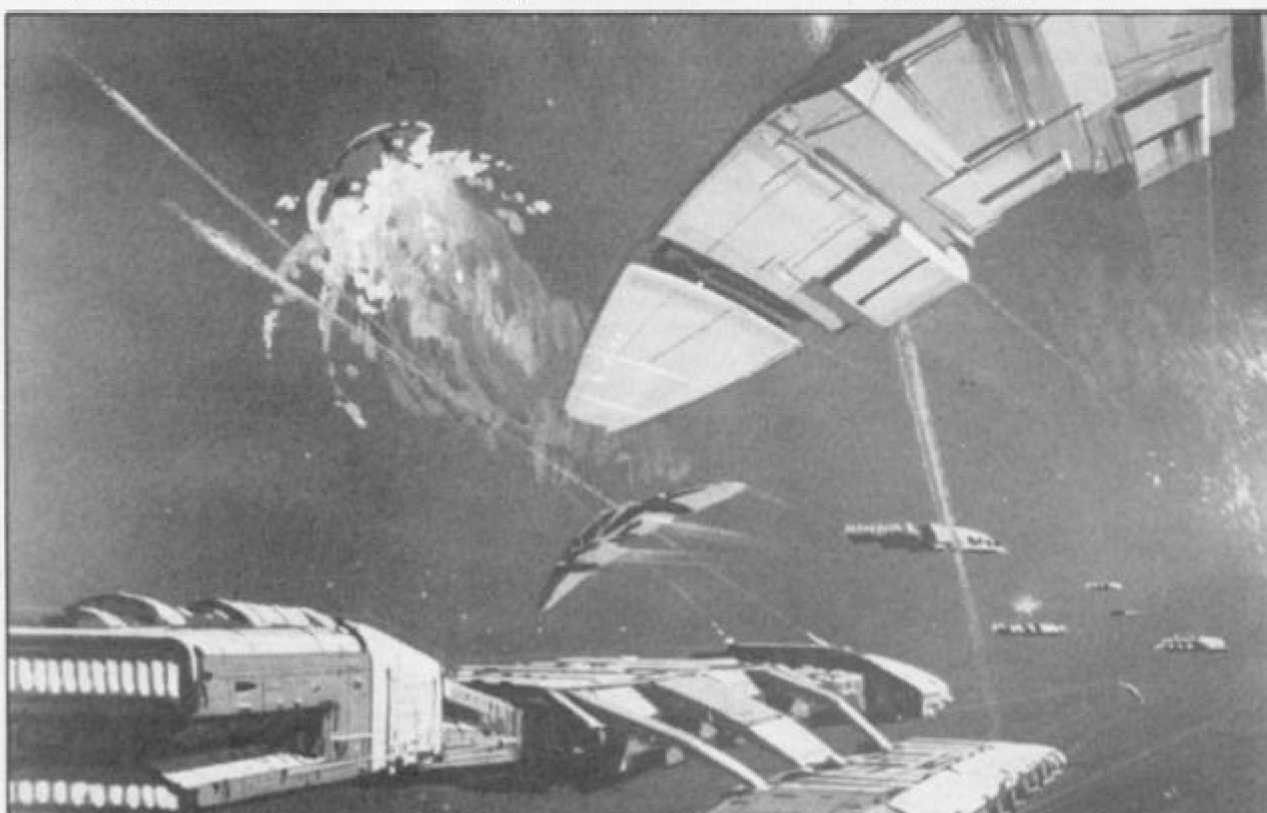
A$ — Background
D — Zero
S — Score
Y — The horizontal position for your space ship

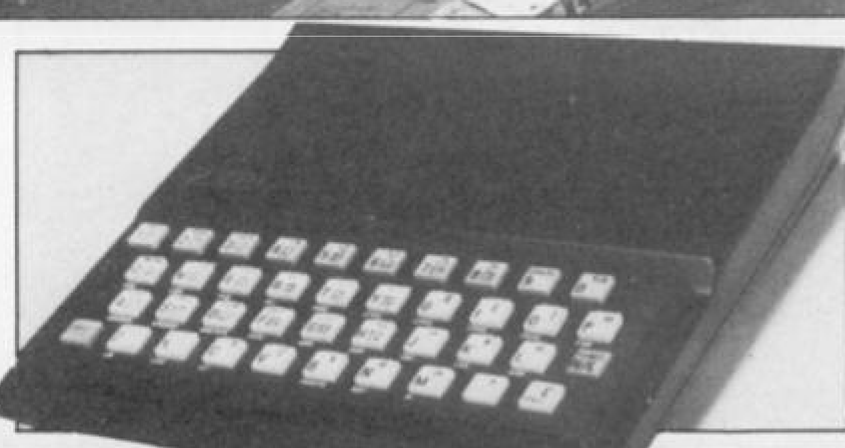
Program description

Here follows a line by line breakdown of the listing:

Lines 2-10 The setting up of the variables.
Line 20 Sets up the print position.
Line 30 Checks to see if your print position has been overprinted with an alien.
Line 40 Prints two pieces of background, then your character, followed by another two pieces of background.
Line 50 Checks to see which key is being pressed.
Line 60 Scrolls the screen up one line.
Lines 61-62 Print a border around the area used.
Line 65 Checks to see if the variable, S, is up to 500. If it is, a subroutine at line 95 begins where a different background is set up.
Line 70 Prints on the 11th line the background and the aliens which are scrolled upwards by line 60.
Line 75 Adds one to the variable, S.
Line 80 Takes the program sequence back to line 20.
Line 90 Prints the score and an explosion when line 30 has reported an alien in the print position of your ship.
Line 94 Stops the program from running into the subroutine at line 100.
Line 110 Prints 'ALIEN TERRITORY' in inverse video onto the screen.
Line 120 Returns to where the subroutine was called from.

```
2   LET A$="(14 Inverse
     spaces)"
5   LET D=0
6   LET S=D
10  LET Y=S
20  PRINT AT 1,Y;
30  IF PEEK (2+PEEK 16398
     + 256 * PEEK 16399)
     =189 THEN GOTO 90
40  PRINT A$ (1 TO 2);
     "(Graphic shifted H)"; A$
     (2 TO 3)
50  LET Y=Y+(INKEY$ =
     "M")-(INKEY$="Z")
60  SCROLL
61  PRINT AT D,D;" (16
     Graphic shifted Gs)"
62  PRINT AT 11,D;" (16
     Graphic shifted Fs)"
65  IF S>=500 THEN GOSUB
     45
70  PRINT AT 10,1; A$; AT
     10, RND * 14; "(INVERSE
     X)"
75  LET S=S+1
80  GOTO 20
90  PRINT S;" (inverse comma,
     Graphic shifted B, Inverse
     full stop, Graphic shifted
     B)"; AT 2, Y-2;
     "(Graphic shifted V,
     Inverse comma, Inverse full
     stop, Graphic shifted B,
     Graphic shifted 2, Inverse
     comma, Graphic shifted M,
     Graphic shifted 2, Graphic
     shifted B)"; AT 3,Y;
     "(Graphic shifted B,
     Graphic shifted C, Graphic
     shiftd F, Graphic shifted
     J)"
94  STOP
100 LET A$="(14 Graphic
     shifted Rs)"
110 PRINT "(inverse ALIEN
     TERRITORY.)"
120 RETURN
```







1K ZX81 GAMES

Fruit machine
Ian Archer

When the program is started (using GOTO 2) the machine will appear in the middle of the screen and the player's money will appear in the top left-hand corner. A string input will appear at the bottom of the screen.

Pressing Newline will spin the reels. When the reels have been spun the player might get a re-spin. If this happens a number input will appear and then the player must enter the number of the reel he/she wishes to re-spin. After this the amount of money the player has won is worked out.

It costs £1 to play and the player wins £5 for two reels the same and £15 for three reels the same. The player's money is then displayed and the string input appears again.

The game can be made easier in the following ways:

1) Alter the number of characters in A$. Add more characters to make it harder, less characters to make it easier. The number in the brackets in line 65 must be the same as the number of characters in A$.

2) Alter the amount that can be won. This can be done by altering the numbers at the end of lines 45 and 50. The number at the end of line 45 is the amount won for two reels (5). The number at the end of line 50 (10) when added to the number at the end of line 45 is the amount won for three reels.

Variables

S	— Player's money. It is used in lines 4-9 as the position of the machine, while its value is 10.
F	— The number for each reel.
N	— The control variable for the loop that 'spins' the reels.
B$(3)	— The three reels.
A$	— The six characters on each reel.
C$	— The dummy variable to start.

Program description

Lines 2-3	Set up variables.
Lines 4-10	Print machine and player's money.
Lines 15-20	Start game and pay for the game.
Lines 25-35	Spin the three reels.
Line 40	Decides whether or not a hold is given.
Lines 45-50	Add up money.
Line 60	Holds.
Lines 65-90	Spin reel "F".

```
1  SAVE "FM"
2  DIM B$(3)
3  LET S=10
4  PRINT TAB S;"(129,128,
   128,128,128,128,130,
   135)"
5  PRINT TAB S;"(128,157,
   128,158,128,159,128,
   133)"
6  PRINT TAB S;"(128,0,
   128,0,128,0,128,133)"
7  PRINT TAB S;"(128,128,
   128,128,128,128,128,
   128)"
8  PRINT TAB S;"(128,137,
   137,137,137,137,128)"
9  PRINT TAB S;"(128,128,
   128,128,128,128,128)"
10 PRINT AT 0,0;"£";S;" "
15 INPUT C$
20 LET S=S-1
25 FOR F=1 TO 3
30 GOSUB 65
35 NEXT F
40 IF RND<.2 THEN GOSUB
   60
45 IF B$(1)=B$(2) OR
   B$(1)=B$(3) OR
   B$(2)=B$(3) THEN LET
   S=S+5
50 IF B$(1)=B$(2) AND
   B$(1)=B$(3)THEN LET
   S=S+10
55 GOTO 10
60 INPUT F
65 LET A=INT (RND * 6)+1
70 FOR N=1 TO A
75 PRINT AT 2,9+F * 2;A
   (N)
80 NEXT N
85 LET B$(F)=A$(A)
90 RETURN LET A$ "(12,13
   8 ,9,10, 24)"
```

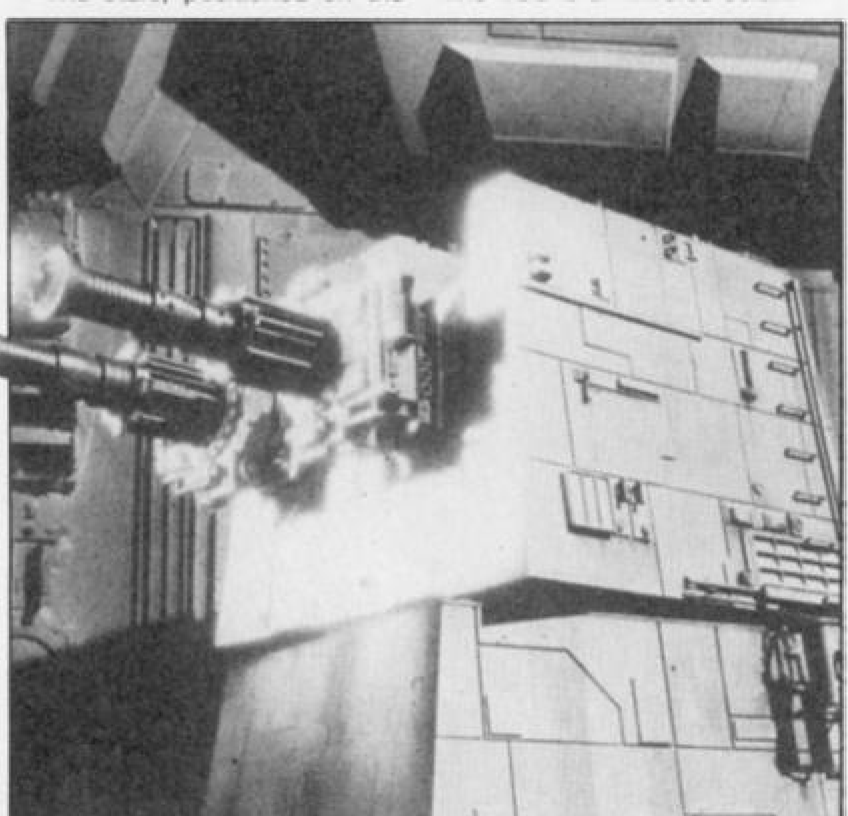
In lines 4-9 and in the variable A$ the numbers in the brackets are character codes and the characters with those codes should be typed in.

Star destruction
Simon Hall

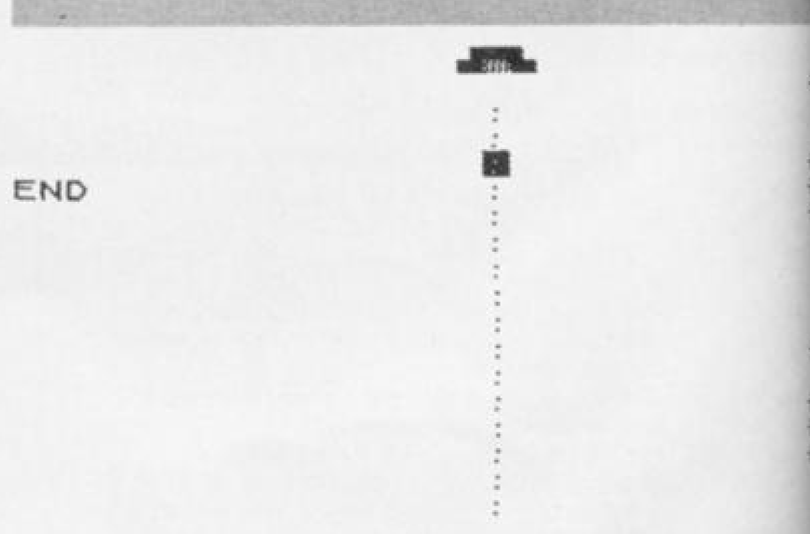
The program, once typed in, will ask you for a skill level — this must be between one and 29, for if it is bigger it will not fit on the screen! A space ship will then be printed on the screen that many columns along the screen.

The stars, positioned on the right of the screen, will then move across the screen. You must shoot them using the '6' key to fire downwards and the '7' key to fire up. Once ten stars have been destroyed, the game will end.

The graphics on line 40 are those obtained from the 'Q', 'G' and 'W' keys and the graphic on line 100 is an inverse colon.



```
  5 LET S=0
 10 PRINT "SKILL"
 20 INPUT A
 30 CLS
 35 FOR M=1 TO 10
 40 PRINT AT 0,A+2;"▀▀▀"
 50 LET B=INT (RND*15)+1
 60 FOR C=0 TO 30
 70 PRINT AT B,C;" *"
 80 PRINT AT S,A+3;" : "
 90 LET S=S+(INKEY$="7")-(INKEY
$="6")
100 PRINT AT S,A+3;"■"
110 NEXT C
120 NEXT M
130 IF M>10 THEN PRINT "END"
```



A sample screen illustration from the program, Star destruction.

Goalkeeper
R Gill

The display shows you in the mouth of your goal, on the left of the screen. 20 balls will be shot at you one at a time. You can move to save them by pressing '6' to go down or '7' to go up. Scoring is by a points system; you score two points for saving a ball, but lose two points if a goal is scored.

At the end of the game the computer will give you your score out of 40.

```
10 LET S=0
20 LET A=5
30 FOR E=0 TO 19
40 LET B=INT(RND ✱ 9+1)
50 FOR C=9 TO 0 STEP -1
60 PRINT AT 2,0;"graphic 7
   ";AT 8,0; "graphic 6 ";
   AT A,1; "graphic 8 ";AT
   A-1,1; " ";AT A+1,1;
   " "; AT B,C; "O ";AT
   0,0; "4 spaces"
70 LET A=A-(INKEY$="7"
   AND A >1)+(INKEYS$ =
   "6")
80 IF C=2 AND A=B THEN
   GOTO 150
90 IF C=1 AND B=2 OR
   C=1 AND B=8 THEN LET
   B=B-1
100NEXT C
110IF B<2 OR B>8 THEN
   GOTO 170
120PRINT AT 0,0; "[GOAL]"
130IF S>=2 THEN LET
   S=S-2
140GOTO 170
150LET S=S+2
160PRINT AT 0,0;" [SAVE] "
170NEXT E
180PRINT AT 0,0; "SCORE:"
   ;S;"/40"
```

Sky diver
Ian and David Gardner

In this program, you are represented by an asterisk and you fall from the sky in a parachute.

Your task is to land safely on a landing pad which can be placed in some difficult places indeed. But this is not the only difficulty as you'll find a flock of crows are hovering around in the sky trying their upmost to block your path. You must use the 'Z' and 'M' keys to move your parachute left and right respectively to avoid the crows.

```
1   LET L=8
2   FOR N=1 TO 25
3   PRINT AT 11+RND ✱ 8,5
    +RND ✱ 15; "◙"
4   NEXT N
5   LET K=9
10  FOR N=1 TO 21
20  LET L=L+(INKEY$ ="M"
    AND L <19)- (INKEY$ =
    "Z" AND L>6)
30  PRINT AT N,L;
40  LET P=PEEK (PEEK
    16398 + PEEK 16399 ✱
    256)
42  IF P=CODE "◙" THEN
    GOTO 100
44  IF P=CODE "—" THEN
    GOTO 200
45  PRINT "✱"
47  LET K=K+INT (RND ✱
    INT PI)-SGN PI
50  PRINT AT CODE "+", K:
    "———"
60  NEXT N
70  PRINT AT PI,PI; "YOU
    MISSED";X
100 PRINT "YOU CRASHED";C
200 PRINT "YOU HIT"
```



Counting
R A Brocklebank

This simple program is for pre-school children.

It sets up a random number of squares up to ten for a child to count. If the correct number of squares is input, then the child will be awarded a tick and a star.

There is a brief guide for operation built into the program, but perhaps more instructions and rewarding speech could be added with more memory. I could add very little in the way of embellishments so that the program could fit into 1K.

```
10  REM "COUNTING"
20  RAND 0
30  CLS
40  LET A=INT ((10 ✱ RND)
    +1)
50  IF A<=5 THEN GOSUB
    200
60  IF A>=6 THEN GOSUB
    300
65  PRINT
70  PRINT,, "HOW MANY
    SQUARES?"
80  INPUT C
90  PRINT C
100 IF C=A THEN PRINT
    "/ ✱"
110 IF C<>A THEN PRINT
    "NOT IT IS ";A
120 INPUT R$
130 GOTO 30
200 FOR N=1 TO A
210 PRINT CHR$ 128; CHR$
    0;
230 NEXT N
240 RETURN
300 FOR N=1 TO 5
310 PRINT CHR$ 128; CHR$
    0;
330 NEXT N
340 PRINT
350 PRINT
360 LET B=A-5
370 FOR M=1 TO B
380 PRINT CHR$ 128; CHR$
    0;
400 NEXT M
410 RETURN
```

Quadratic formulae
Julian Clamp

This program is fairly self-explanatory and will solve any quadratic equation and print out the results.

A quadratic equation is of the form:

$Ax^2 + Bx + C = 0$

And the missing value of x is the one you wish to calculate. All you have to do is respond to the program's prompts with the values for A, B and C and the program will give you a value for x.

```
THE QUADRATIC FORMULA

      -
X=-B+/BB-4AC
     V
  ___________
       2A

WORKS FOR THIS...
AXX+BX+C=0

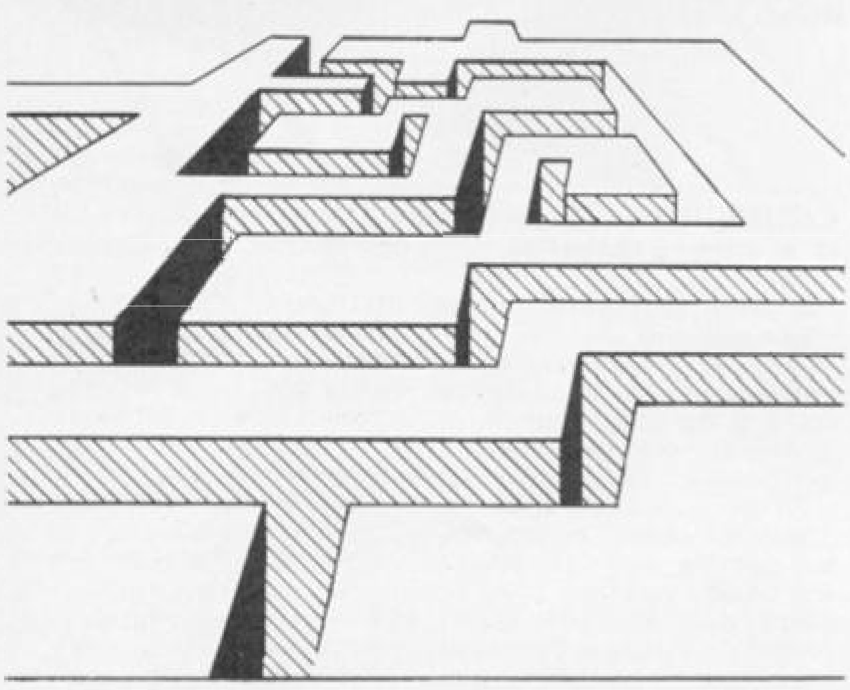
INPUT VALUES FOR A,B AND C IN TH
AT ORDER
A=2
B=-7
C=-10
```

A screen dump showing the program, Quadratic formulae, in action.

```
X=4.5894542 OR -1.0894542
  20 PRINT AT 0,0;"THE QUADRATIC
FORMULA"
  30 PRINT AT 0,0;"THE QUADRATIC
FORMULA"
  40 PRINT AT 2,0;"      -  ______"
  50 PRINT AT 3,0;"X=-B+/BB-4AC"
  60 PRINT AT 4,0;"     V"
  70 PRINT AT 5,0;"  __________"
  80 PRINT AT 6,0;"       2A"
  90 PRINT AT 8,0;"WORKS FOR THI
S..."
 100 PRINT AT 9,0;"AXX+BX+C=0"
 110 IF INKEY$="" THEN GOTO 10
 120 PRINT AT 11,0;"INPUT VALUES
FOR A,B AND C IN THAT ORDER"
 130 INPUT A
 140 PRINT AT 13,0;"A=";A
 150 INPUT B
 160 PRINT AT 14,0;"B=";B
 170 INPUT C
 180 PRINT AT 15,0;"C=";C
 190 LET Z=-B
 200 LET Y=SQR ((B*B)-(4*(A*C)))
 210 LET P=2*A
 220 LET X=(Z+Y)/P
 230 LET Q=(Z-Y)/P
 240 PRINT AT 17,0;"X=";X;" OR "
;Q
```

3D maze

An explosive 9K program for the ZX80, courtesy of Mike Hyams of Middlesex.



The plot for this game is that you are a member of a bomb disposal squad and information has led to the suspicion that a bomb has been hidden somewhere in the corridors of a building.

You decide the size of the building you are to enter, but if you're not feeling too confident then you may think twice before asking the computer for the maximum size of a 15 by nine maze.

Once you have decided on the size of maze you require, the floor plan of the building will be shown to you for a period of time (the length of time the floor plan is shown to you depends on the complexity of the corridors). You will find there is only one way through the maze and you must be quick about finding it and then committing it to memory.

If you don't manage to find the bomb (represented by an 'O' character) in time, the bomb will explode and you with it. You are represented by an asterisk. Should you get hopelessly lost you can always type 'H' and you will be shown the floor plan again and your position, but this will cost you valuable time.

Notes on the program

The machine code routines in lines 10 and 12 are a PAUSE routine. The machine code routine in line 14 stores and retrieves the maze plan in a high memory location. All the 1s and 0s are numbers and not letters — it is important that these are entered correctly.

When the program is RUN, there is a short wait while the above machine code is LOADed into the memory.

Lost?

According to how large you specify the maze, there will be a time limit set which takes the size of the maze into account giving you a specific number of moves to find and defuse the bomb. Each time you ask for help 10 points are deducted from this count so you see how important it is to look very carefully at the floor plan when you start.

To see how much time you have left, you could always enter the following line:

```
755 PRINT "MOVES LEFT?";H
*W*8/10-GOES
```

A last word — if you do run out of time, the screen will go berserk for a couple of seconds. This is not a fault in the program — what else would you expect to happen when a bomb goes off?

```
  1 GO TO 20
 10 LET Q$="E52A1C40ED4B244004A
FB93E7628027723 10FC11FFFF26BF01F
EF7ED78F6E06F2FFE019FB4A5A35FC50
0CB0438ED41ED78171795E618C620322
340D9062A10FE3E0FD3FF3EEC"
 11 GO SUB 9900
 12 LET Q$="06192A0C40CBFCCDAD0
13EF3042BFD35231800CDAD01061D000
010FC00D91520AF7B1E78E1191E0ABE2
804231D20F9EB2BC9"
 13 GO SUB 9910
 14 LET Q$="2A0C40114871 01D602E
DB0C9ED5B0C4021487101D602EDB0C9"
 15 GO SUB 9910
 16 RETURN
 20 PRINT
 21 PRINT
 22 PRINT
 23 PRINT ,"█████████████"
 30 PRINT ,"3 D - M A Z E"
 31 PRINT ,"█████████████"
 32 PRINT
 33 PRINT "         PRESS N/L TO S
TART"
 34 INPUT Z$
 35 GO SUB 10
 40 PRINT ,,,,"DO YOU WANT THE
INSTRUCTIONS     (Y/N)"
 41 INPUT Q$
 42 IF Q$="Y" THEN GO TO 7000
 48 CLS
 49 LET GOES=1
 50 PRINT
 60 PRINT "HOW MANY CORRIDORS A
CROSS       (FROM 4-15)"
 70 INPUT W
 80 IF W<4 OR W>15 THEN GO TO 7
0
 90 PRINT
100 PRINT "HOW MANY CORRIDORS D
EEP         (FROM 4-9)"
110 INPUT H
120 IF H<4 OR H>9 THEN GO TO 11
0
121 PRINT
122 PRINT "PLEASE PRESS ENTER A
ND WAIT FOR ABOUT ";(H*W)/2;" SE
CONDS."
124 INPUT Z$
125 CLS
130 FOR I=1 TO H
140 FOR J=1 TO W
150 PRINT CHR$(135);CHR$(131);
160 NEXT J
170 PRINT "█ ";
171 GO SUB 174
172 GO TO 180
174 FOR J=1 TO 32-(W*2+1)
175 PRINT " ";
176 NEXT J
177 RETURN
180 FOR J=1 TO W
190 PRINT "█ ";
200 NEXT J
210 PRINT "█ ";
211 GO SUB 174
220 NEXT I
230 FOR J=1 TO W
240 PRINT CHR$(131);CHR$(131);
250 NEXT J
260 PRINT "█ ";
261 GO SUB 174
270 RANDOMISE
280 LET C=1
281 LET B=0
283 LET X=0
284 LET Y=0
285 LET D=0
286 LET M=0
290 DIM A(W*H)
300 LET Q=PEEK(16396)+256*PEEK(
```

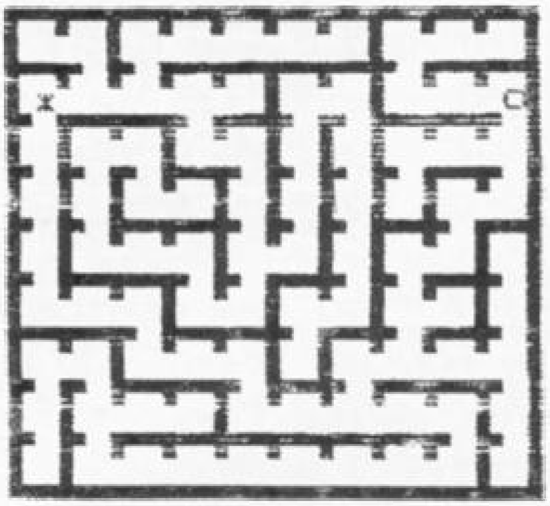
```
16397)
310 LET X=RND(W)
320 LET Y=RND(H)
360 LET A((X-1)*H+Y)=1
370 LET D=A((X-1)*H+Y-1-(Y=1))+
2*A((X+(X=W))*H+Y)+4*A((X-1)*H+Y
+1+(Y=H))+8*A((X-2-(X=1))*H+Y)
372 GO TO 373+3*D
373 GO TO 431+3*(RND(4)-1)
376 GO TO 431+3*(RND(3)-1)+3
379 LET M=RND(3)+1
380 IF M>3 THEN LET M=M-4
381 GO TO 431+3*M
382 GO TO 431+3*(RND(2)-1)+6
385 LET M=RND(3)+2
386 IF M>3 THEN LET M=M-4
387 GO TO 431+3*M
388 GO TO 431+6*(RND(2)-1)+3
391 LET M=RND(2)+2
392 IF M>3 THEN LET M=M-4
393 GO TO 431+3*M
394 GO TO 440
397 GO TO 431+3*(RND(3)-1)
400 GO TO 431+3*(RND(2)-1)+3
403 GO TO 431+6*(RND(2)-1)
406 GO TO 437
409 GO TO 431+3*(RND(2)-1)
412 GO TO 434
415 GO TO 431
418 LET X=RND(W)
419 LET Y=RND(H)
420 IF A((X-1)*H+Y)=0 THEN GO T
O 418
421 GO TO 370
431 POKE 4+Q+(2*Y-2)*33+2*X-1,0
432 LET Y=Y-1
433 GO TO 450
434 POKE 4+Q+(2*Y-1)*33+2*X,0
435 LET X=X+1
436 GO TO 450
437 POKE 4+Q+(2*Y)*33+2*X-1,0
438 LET Y=Y+1
439 GO TO 450
440 POKE 4+Q+(2*Y-1)*33+2*X-2,0
441 LET X=X-1
450 LET C=C+1
490 IF C=H*W THEN GO TO 510
500 GO TO 360
510 LET A=1
512 LET B=RND(H)
514 LET D=RND(H)
515 POKE 7+Q+(D*2-1)*33+W*2-1,5
2
517 PRINT "STUDY THE MAZE CAREF
ULLY"
520 FOR I=1 TO 21-(H*2+1)
521 PRINT "
          "
522 NEXT I
525 LET I=USR(30120)
526 REM *****COPY SCREEN***
529 POKE 7+Q+(B*2-1)*33+1,20
530 LET Z=RND(4)
531 LET A$="NORTH"
532 IF Z=2 THEN LET A$="EAST"
533 IF Z=3 THEN LET A$="SOUTH"
534 IF Z=4 THEN LET A$="WEST"
538 PRINT "YOU ARE FACING ";A$
540 LET F=0
542 FOR I=1 TO H
544 FOR J=1 TO W
546 LET P=(I-1)*66+PEEK(16396)+
256*PEEK(16397)
547 LET F=P+2*J
548 IF I=1 THEN IF J=1 THEN LET
F=F+3
549 LET A((J-1)*H+I)=10000-(PEE
K(F+32)>0)-1000*(PEEK(F)>0)-100*
(PEEK(F+34)>0)-10*(PEEK(F+66)>0)
552 NEXT J
554 NEXT I
558 FOR I=1 TO (H*W)/10
560 LET L=USR(30000)
561 REM *****PAUSE*******
565 NEXT I
566 CLS
567 PRINT ,"    TIME UP"
570 PRINT ,"    ▀▀▀▀ ▀▀"
572 PRINT
573 PRINT "USE THE FOLLOWING CO
MMANDS WHEN MOVING THROUGH THE M
AZE"
574 PRINT
575 PRINT ,,,,,"7 - MOVE FORWAR
D"
576 PRINT ,,,,,"5 - LOOK LEFT"
577 PRINT ,,,,,"8 - LOOK RIGHT"
578 PRINT ,,,,,"6 - TURN AROUND
"
579 PRINT ,,,,,"H - HELP"
580 PRINT ,,,,,"R - RESIGN"
581 PRINT
585 PRINT
586 PRINT "PRESS N/L WHEN READY
"
587 INPUT Z$
590 LET ACR=0
595 LET OBJ=(W-1)*H+D
599 GO SUB 8000
600 LET C=ACR*H+B
605 LET LOOP=0
609 REM *****LEFT*******
610 LET SIDE=Z-1
620 IF SIDE=0 THEN LET SIDE=4
630 GO SUB 8100
640 GO SUB (WALL>28)*100+4100+L
OOP*500
649 REM *****RIGHT*******
650 LET SIDE=Z+1
660 IF SIDE=5 THEN LET SIDE=1
670 GO SUB 8100
680 GO SUB (WALL>28)*100+4150+L
OOP*500
690 REM *****AHEAD*******
700 LET SIDE=Z
710 GO SUB 8100
715 IF LOOP=0 THEN LET AHEAD=WA
LL
725 LET Q=PEEK(16396)+PEEK(1639
7)*256
727 IF C=OBJ THEN POKE Q+643-(L
OOP-1)*66,52
728 IF WALL>28 THEN GO TO 750
730 LET LOOP=LOOP+1
740 IF LOOP>4 THEN GO TO 750
745 LET C=(Z=1 AND C-1) OR (Z=2
AND C+H) OR (Z=3 AND C+1) OR (Z
=4 AND C-H)
747 GO TO 609
750 GO SUB 4300+LOOP*500
760 INPUT Q$
770 IF Q$="5" THEN LET Z=Z-1
780 IF Q$="6" THEN LET Z=Z+2
790 IF Q$="8" THEN LET Z=Z+1
800 IF Q$="7" AND AHEAD=28 THEN
GO TO 850
803 IF Q$="R" THEN GO TO 990
805 IF Z>4 THEN LET Z=Z-4
810 IF Z<1 THEN LET Z=Z+4
815 IF Q$="H" THEN GO TO 824
820 GO TO 599
824 GO SUB 8000
827 LET ZZ=USR(30132)
830 LET Q=PEEK(16396)+PEEK(1639
7)*256
833 POKE Q+(B*2-1)*33+ACR*2+2,2
0
836 FOR I=1 TO (H*W)/20
840 LET ZZ=USR(30000)
843 NEXT I
844 CLS
845 PRINT "TIME UP",,,,"▀▀▀▀ ▀▀
",,,,"PRESS N/L"
846 INPUT Q$
847 LET GOES=GOES+10
848 GO TO 599
```

```
 850 IF Z=1 THEN LET B=B-1
 860 IF Z=3 THEN LET B=B+1
 870 IF Z=2 THEN LET ACR=ACR+1
 880 IF Z=4 THEN LET ACR=ACR-1
 890 IF OBJ=ACR*H+B THEN GO TO 9
10
 895 LET GOES=GOES+1
 896 IF GOES>H*W*8/10 THEN GO TO
7500
 900 GO TO 599
 910 CLS
 920 PRINT "WELL DONE",,,"YOU HA
VE FOUND THE BOMB."
 930 PRINT "IT TOOK YOU ";GOES;"
MOVES TO FIND IT"
 940 PRINT ,,,,"WOULD YOU LIKE A
NOTHER GO?"
 945 PRINT "(INPUT Y/N)"
 950 INPUT Q$
 960 IF Q$="Y" THEN RUN
 970 PRINT ,,,,"ALRIGHT THEN :-
GOODBYE"
 980 STOP
 990 CLS
1000 PRINT "YOU GAVE UP AFTER ";
GOES;" MOVES","COWARD"
1005 PRINT "YOU STILL HAD ";H*W*
8/10-GOES;" MOVES LEFT."
1010 PRINT
1020 GO TO 940
4000 REM 1ST LEFT WALL
4001 LET Q=PEEK(16396)+PEEK(1639
7)*256
4005 POKE Q+1,136
4010 POKE Q+35,136
4015 POKE Q+662,8
4020 POKE Q+694,8
4025 FOR I=68 TO 629
4030 POKE Q+I,130
4033 POKE Q+I+29,2
4035 LET I=I+32
4040 NEXT I
4045 RETURN
4050 REM 1ST RIGHT WALL
4051 LET Q=PEEK(16396)+PEEK(1639
7)*256
4055 POKE Q+32,8
4060 POKE Q+64,8
4065 POKE Q+691,136
4070 POKE Q+725,136
4095 RETURN
4100 REM NO 1ST LEFT WALL
4101 LET Q=PEEK(16396)+PEEK(1639
7)*256
4105 POKE Q+34,3
4110 POKE Q+35,3
4115 POKE Q+661,131
4120 POKE Q+662,131
4130 GO TO 4025
4150 REM NO 1ST RIGHT WALL
4151 LET Q=PEEK(16396)+PEEK(1639
7)*256
4155 POKE Q+64,3
4160 POKE Q+65,3
4165 POKE Q+691,131
4170 POKE Q+692,131
4175 RETURN
4300 REM NO 1ST AHEAD WALL
4310 LET Q=PEEK(16396)+PEEK(1639
7)*256
4320 FOR I=36 TO 63
4330 POKE Q+I,3
4335 POKE Q+I+627,131
4340 NEXT I
4350 RETURN
4500 REM 2ND LEFT WALL
4510 LET Q=PEEK(16396)+PEEK(1639
7)*256
4515 POKE Q+69,136
4517 POKE Q+103,136
4519 POKE Q+137,136
4521 POKE Q+630,8
4523 POKE Q+598,8
4525 POKE Q+566,8
4530 FOR I=170 TO 533
4535 POKE Q+I,130
4538 POKE Q+I+23,2
4540 LET I=I+32
4545 NEXT I
4547 RETURN
4550 REM 2ND RIGHT WALL
4551 LET Q=PEEK(16396)+PEEK(1639
7)*256
4555 POKE Q+96,8
4557 POKE Q+128,8
4559 POKE Q+160,8
4561 POKE Q+589,135
4563 POKE Q+623,136
4565 POKE Q+657,136
4590 RETURN
4600 REM NO 2ND LEFT WALL
4601 LET Q=PEEK(16396)+PEEK(1639
7)*256
4603 POKE Q+135,3
4605 POKE Q+136,3
4607 POKE Q+137,3
4610 POKE Q+564,131
4615 POKE Q+565,131
4620 POKE Q+566,131
4630 GO TO 4530
4650 REM NO 2ND RIGHT WALL
4651 LET Q=PEEK(16396)+PEEK(1639
7)*256
4655 POKE Q+160,3
4660 POKE Q+161,3
4665 POKE Q+162,3
4670 POKE Q+589,131
4675 POKE Q+590,131
4680 POKE Q+591,131
4690 RETURN
4800 REM 2ND AHEAD
4801 LET Q=PEEK(16396)+PEEK(1639
7)*256
4805 FOR I=138 TO 159
4810 POKE Q+I,3
4820 POKE Q+I+429,131
4830 NEXT I
4840 RETURN
5000 REM 3RD LEFT WALL
5001 LET Q=PEEK(16396)+PEEK(1639
7)*256
5005 POKE Q+171,135
5010 POKE Q+205,136
5015 POKE Q+502,8
5020 POKE Q+534,8
5025 FOR I=238 TO 469
5030 POKE Q+I,130
5033 POKE Q+I+19,2
5035 LET I=I+32
5040 NEXT I
5045 RETURN
5050 REM 3RD RIGHT WALL
5051 LET Q=PEEK(16396)+PEEK(1639
7)*256
5055 POKE Q+521,136
5060 POKE Q+555,136
5065 POKE Q+192,8
5070 POKE Q+224,8
5075 RETURN
5100 REM NO 3RD LEFT WALL
5101 LET Q=PEEK(16396)+PEEK(1639
7)*256
5105 POKE Q+204,3
5110 POKE Q+205,3
5115 POKE Q+501,131
5120 POKE Q+502,131
5140 GO TO 5025
5150 REM NO 3RD RIGHT WALL
5151 LET Q=PEEK(16396)+PEEK(1639
7)*256
5155 POKE Q+224,3
5160 POKE Q+225,3
5165 POKE Q+521,131
5170 POKE Q+522,131
5180 RETURN
5300 REM 3RD AHEAD
```

```
5301 LET Q=PEEK(16396)+PEEK(1639
7)*256
5310 FOR I=206 TO 223
5315 POKE Q+I,3
5320 POKE Q+I+297,131
5330 NEXT I
5340 RETURN
5500 REM 4TH LEFT WALL
5501 LET Q=PEEK(16396)+PEEK(1639
7)*256
5505 POKE Q+239,136
5510 POKE Q+273,136
5515 POKE Q+438,8
5520 POKE Q+470,8
5525 FOR I=306 TO 405
5530 POKE Q+I,130
5535 POKE Q+I+15,2
5540 LET I=I+32
5543 NEXT I
5547 RETURN
5550 REM 4TH RIGHT WALL
5551 LET Q=PEEK(16396)+PEEK(1639
7)*256
5555 POKE Q+256,8
5560 POKE Q+288,8
5565 POKE Q+453,136
5570 POKE Q+487,136
5580 RETURN
5600 REM NO 4TH LEFT WALL
5601 LET Q=PEEK(16396)+PEEK(1639
7)*256
5605 POKE Q+272,3
5610 POKE Q+273,3
5615 POKE Q+437,131
5620 POKE Q+438,131
5640 GO TO 5525
5650 REM NO 4TH RIGHT WALL
5651 LET W=PEEK(16396)+PEEK(1639
7)*256
5655 POKE Q+288,3
5660 POKE Q+289,3
5665 POKE Q+453,131
5670 POKE Q+454,131
5680 RETURN
5800 REM 4TH AHEAD
5801 LET Q=PEEK(16396)+PEEK(1639
7)*256
5810 FOR I=274 TO 287
5820 POKE Q+I,3
5830 POKE Q+I+165,131
5840 NEXT I
5850 RETURN
6000 REM 5TH LEFT WALL
6001 LET Q=PEEK(16396)+PEEK(1639
7)*256
6010 POKE Q+307,136
6020 POKE Q+406,8
6025 POKE Q+340,130
6030 POKE Q+373,130
6035 POKE Q+353,2
6040 POKE Q+386,2
6045 RETURN
6050 REM 5TH RIGHT WALL
6051 LET Q=PEEK(16396)+PEEK(1639
7)*256
6060 POKE Q+320,8
6070 POKE Q+419,136
6080 RETURN
6100 REM NO 5TH LEFT WALL
6101 LET Q=PEEK(16396)+PEEK(1639
7)*256
6110 POKE Q+307,3
6120 POKE Q+406,131
6130 GO TO 6025
6150 REM NO 5TH RIGHT WALL
6151 LET Q=PEEK(16396)+PEEK(1639
7)*256
6160 POKE Q+320,3
6170 POKE Q+419,131
6180 RETURN
6300 REM 5TH AHEAD
6301 LET Q=PEEK(16396)+PEEK(1639
7)*256
6310 FOR I=308 TO 319
6320 POKE Q+I,3
6330 POKE Q+I+99,131
6340 NEXT I
6350 RETURN
6800 LET Q=PEEK(16396)+PEEK(1639
7)*256
6810 POKE Q+346,15
6820 RETURN
7000 CLS
7005 PRINT ,"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
7010 PRINT ,"3 D - M A Z E"
7020 PRINT ,"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
7030 PRINT
7040 PRINT
7050 PRINT "YOU ARE A MEMBER OF
A BOMB      DISPOSAL SQUAD AND M
UST FIND A  BOMB HIDDEN SOMEWHER
E IN THE    CORRIDORS OF THIS BU
ILDING."
7060 PRINT
7070 PRINT "YOU MAY DECIDE ON TH
E DIMENSIONSOF THE BUILDING ACCO
RDING TO HOWCONFIDENT YOU ARE."
7080 PRINT "(ONLY THE HARDIEST O
F PLAYERS    WILL TRY THE 15 BY 9
 MAZE)"
7090 PRINT
7100 PRINT "AFTER YOU HAVE DECID
ED ON A SIZEFOR THE BUILDING THE
RE WILL BE   A SHORT PAUSE WHILE
THE COMPUTERWORKS OUT THE CORRID
ORS (THERE   IS ONLY ONE CORRECT
ROUTE)"
7110 PRINT ,,,,"****PRESS N/L TO
 CONTINUE*****"
7120 INPUT Q$
7130 CLS
7140 PRINT "YOU WILL THEN BE SHO
WN A MAP OF THE BUILDING FOR A S
ET AMOUNT OFTIME ACCORDING TO HO
W LARGE IT   IS. YOU (*) MUST THE
N FIND THE   BOMB (O) BEFORE IT G
OES OFF."
7145 PRINT
7150 PRINT "IF YOU DONT GET TO T
HE BOMB IN   TIME, THEN .......?"
7160 PRINT
7165 PRINT "IF YOU GET LOST, ENT
ERING H WILLSHOW YOU A MAP OF TH
E BUILDING......BUT YOU WILL LOS
E A LOT OF   TIME IN THE PROCESS.
"
7166 PRINT "IN EXTREME CASES OF
FRUSTRATION YOU MAY RESIGN."
7168 PRINT
7170 PRINT "GOOD LUCK AND MAY TH
E FORCE BE   WITH YOU."
7180 PRINT
7190 PRINT
7200 PRINT "PRESS N/L"
7205 INPUT Q$
7210 GO TO 48
7500 POKE 30021,1
7510 LET Q=PEEK(16396)+PEEK(1639
7)*256
7520 FOR I=1 TO 100
7530 POKE Q+RND(700),RND(9)+2
7540 LET ZZ=USR(30000)
7550 NEXT I
7560 PRINT "BAD LUCK : THE BOMB
WENT OFF"
7999 STOP
8000 CLS
8005 FOR N=1 TO 22
8010 PRINT "
"
8020 NEXT N
8030 RETURN
8100 LET Q$=STR$(H(C))
8110 FOR I=1 TO SIDE
8120 LET Q$=TL$(Q$)
8130 NEXT I
```

ZX80 GAME

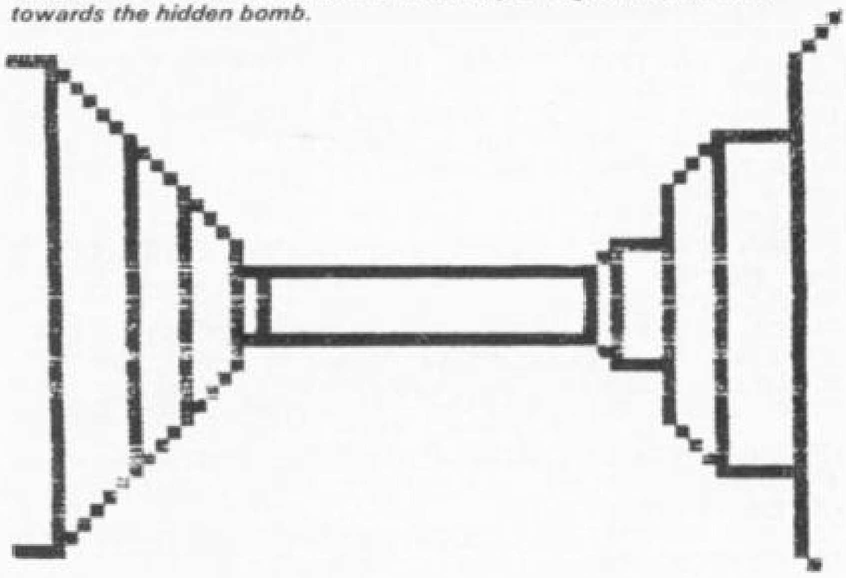
```
8140 LET WALL=CODE(Q$)
8150 RETURN
9900 LET W=30000
9910 POKE W,CODE(W$)*16+CODE(TL$
(Q$))-476
9920 LET W=W+1
9930 LET Q$=TL$(TL$(Q$))
9940 IF Q$="" THEN RETURN
9950 GO TO 9910
```

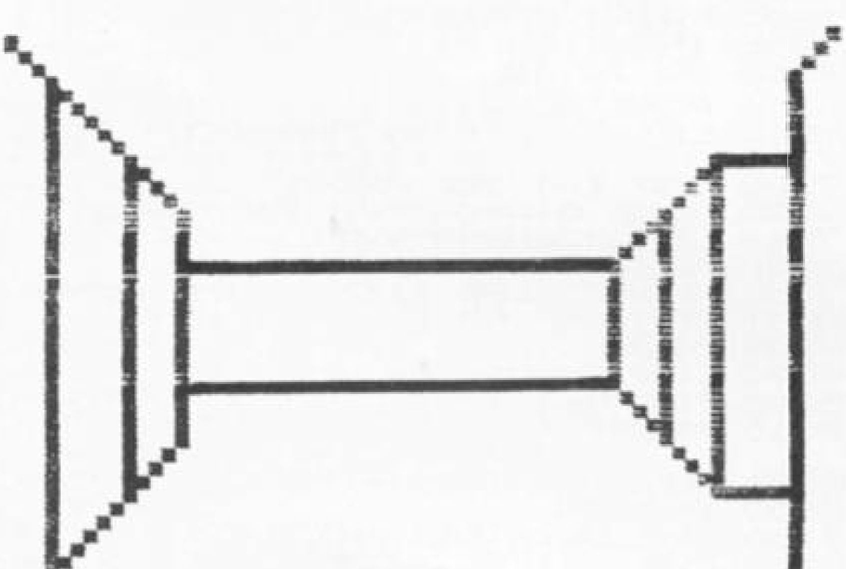


STUDY THE MAZE CAREFULLY

You will get a quick look at the maze before you start the game showing your location and the position of the bomb. You'll have to be quick though, as it will only be shown on-screen for a very short time!

Here below are two views of the maze as you negotiate your way towards the hidden bomb.





Kludo for 2 to 6 Players with rooms, weapons and suspects. Random dealing and solutions. Graphic board with moving pieces. Good fun for all the family.

&

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&

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&

Starbuster 1 Player game. You find yourself hemmed in by a Galaxy of Stars, Novas and Super novas. Move and blast while fuel lasts. High Score Chart.

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ZX81 DE-LUXE LOADING AID comprises electronic circuit housed in smart black case. Red, green & yellow lights (LED) allow volume to be adjusted easily for perfect LOADing. Pushbutton to RESET computer. Hear voiceovers & position tape accurately using EARPHONE supplied. Supplied with LOAD/SAVE switch fitted so both EAR & MIC leads may be left connected. Complete with full instructions. ". . . It is designed to ensure that even tapes made on 'foreign' cassette players load first time . . ." ZX Computing Oct/Nov 1982. This is not just a cheap VU meter . . . this one works. Only £18.70 (incl. P&P in UK only). Spectrum version only £18.95.

ZX81 KEYBOARD BEEPER — brings the keyboard to life providing audible feedback to keyboard entry. All 210 characters beep in either SLOW or FAST modes. Fits inside — no trailing wires — no soldering necessary as all connections simply plug-in. Illustrated instructions incl. Only £10.95 (incl. P&P in UK only)

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Flat flexible ribbon cable suits "other keyboard" to ZX81 or Spectrum interconnection (which requires 5 & 8 way) available any length maximum 19 way 1p per 10mm (e.g. 100mm of 5 way = 50p). Plus ZX81 & Spectrum type keyboard connectors 5 way 95p ea.; 8 way £1.05 ea.

BOOKS "Spectrum Graphics" 1982 Nick Hampshire £7.95. "Spectrum ROM Decoded/Disassembly" An annotated disassembly of the Spectrum ROM 1982 MOI £4.90. "The ZX Spectrum & how to get the most from it" 1983 Ian Sinclair £6.95. "Z80 Instruction Handbook" 1982 Wadsworth £5.50. "Introduction to the Z80 Microcomputer" 1982 Khambata £9.50.

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48K Spectrum and 16K ZX81 versions of the cassette are available. Please specify which you require.

Professional Computer Assisted Learning materials from:

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108 Hermitage Woods Crescent, St Johns,
Woking, Surrey GU21 1UF.

The cassettes are available by post from this address, or from retail outlets. For overseas orders, please add £1.00 to cover the cost of airmail postage.

They're Here

After months of speculation, the Microdrives were formally announced to the world on July 28, 1983. And with their launch came the promise from Nigel Searle, managing director of Sinclair Research, that Spectrum owners would be using Microdrives with their Spectrums within days.

Details of the Microdrives have been mailed to 100,000 Spectrum owners, whilst order forms have been sent to 1,000 customers initially. Mr Searle announced that customers will be restricted to no more than two Microdrives, but they can order as many cartridges as they want. Delivery of the items would be within 28 days.

The three products launched at the press conference were the ZX Microdrive, priced at £49.95; the ZX Interface 1, priced at £29.95 if bought with a Microdrive, £49.95 if purchased alone; and the cartridges for the Microdrive which will retail at £4.95 each.

Talking about the Microdrives, Nigel Searle went on to say that "The user will have the speed, capability and operating system usually associated with a disc drive. It is extremely simple for the first time user."

Asked why the Microdrives had been so long in the pipeline, Sir Clive Sinclair was succinct and to the point "That's a very good question — it's bloody hard to do. We are making the equivalent to a disc drive.

We did not anticipate the size of the back-up support that would be needed. When we first dreamed it up, the Spectrum had not even been launched. Instead of thousands, it will be hundreds of thousands — and an unbelievable amount of cartridges."

Asked about the manufacture of the Microdrives and the cartridges, Nigel Searle said that they would be aiming to produce 20,000 Interface units a month, and that the Microdrive production will be related to customer orders although the suspicion is that they will need to produce many more Microdrives than Interface 1 units. Sinclair Research are aiming to manufacture around half a million cartridges a month.

Asked whether Sinclair Research would be bringing out any software on cartridge especially for the Microdrives, it was announced this would be a future project but at the moment it is only thought that the current Sinclair titles will be available on cartridge.

Sinclair Research are supplying Microdrives and cartridges to software houses so they can bring out their own programs on the storage format. Nigel Searle added "It will take a few months for software on Microdrives to overtake that on cassettes." At present, the new peripherals are being produced at one Thorn EMI Datatech plant. And Timex-Dundee, which made Spectrums, are being considered as a second manufacturer.

As an example of the speed of the new Microdrives a demonstration was given using the Flight Simulator program available through Sinclair Research. Normally taking six to seven minutes to load, the program was found on the cartridge within six seconds and after another six seconds was fully loaded up and ready to play — a very effective display of its prowess!

Asked when the Microdrives would be on sale in the High Street shops, Nigel Searle could give no definite times. However, he did mention the availability of a new device called the ZX Interface 2 which should be launched in the Autumn. This will allow ROM cartridges to be used with the Spectrum and also provide the facility for joysticks. For more information on this unit, you will have to wait along with the rest of us until Autumn!

Customers who bought Spectrums from shops and thus not on the Sinclair Research mailing list should send their names and addresses only on a postcard to Sinclair Research, Department M, Freepost, Camberley, Surrey GU15 3BR and they will add your name to the list.

Nigel Searle began his prepared speech with the words "This is not just another press conference, but a major step forward for Sinclair computers". You know, I think he may just have something there.

For more details on the technical capabilities of the Microdrives and the Interface 1, check out the review within these pages.



The ZX Spectrum complete with the Interface 1 unit (although invisible in this picture, it is there!) and ZX Microdrives. You can add up to eight drives to the Spectrum in this way. The inset photograph shows Sinclair Research's managing director, Nigel Searle, expounding on the new devices — Sir Clive watches the proceedings with interest.

Brainwave '83

If you're looking around for somewhere to check out the latest software and hardware for Christmas, you could always visit a new exhibition called Brainwave '83. The exhibition will be held between 4-6 November, 1983, at the National Exhibition Centre, Birmingham.

Claimed to be the first home computing, video and electronics show for the family, Brainwave '83 will be attracting many companies in the Sinclair field. Amongst those already due to be exhibiting there are Kayde Electronics Systems Ltd, Elfin Software Ltd, Micronet 800, Computer Rentals, Automate UK, Kempston Micro, Fuller Micro Systems and Walters Computer Systems.

The final details of the exhibition are still being arranged, but if you would like further details you could always contact Sheridan Communications Ltd, 15 Greenfield Crescent, Edgebaston, Birmingham B15 3AU. Telephone enquiries can be made on 021-454 4124.

Software . . . . In Brief

- Kemp Ltd have announced the launch of three sophisticated ledger accounting programs for the 48K Spectrum. The programs are Sales Ledger, Purchase Ledger and Stock Accounting/Control and are available at £14.95 each. For further details get in touch with Kemp Ltd on 01-444 5499 or write to them at 43, Muswell Hill, London N10 3PN.

- Formed by Ian Andrew (author of Mined-Out), a new company Incentive Software Ltd has evolved to release Splat, a 48K program for the ZX Spectrum. The game involves exploration, survival and eating grass! However, there is a chance you could win £500 if you get the highest score, so you'd better get in contact with the people at 54 London Street, Reading RG1 4SG, fast! Telephone enquiries can be made on 0734 591678.

- Ultimate Play The Game have released two brand new games for the Spectrum, both to retail at £5.50. The first, Tranz Am, involves players taking part in a real time, automobile pursuit race across America. The other release is called Cookie and features Charlie Chef and his fight against the Bin Monster. For further information contact Ultimate at The Green, Ashby de la Zouch, Leicestershire LE6 5JU or 'phone 0530 411485.

- Following the launch of their program, Accounts Spectrum, Hestacrest Ltd have introduced another business program called Sales/Purchases Spectrum. Suitable for small businesses, it can be used as either a sales ledger system or a purchase ledger system, and can handle up to 1,000 monthly transactions and 250 customers. For further details, write to Hestacrest Ltd, PO Box 19, Leighton Buzzard, Bedfordshire LU7 0DG or 'phone 052-523 785.

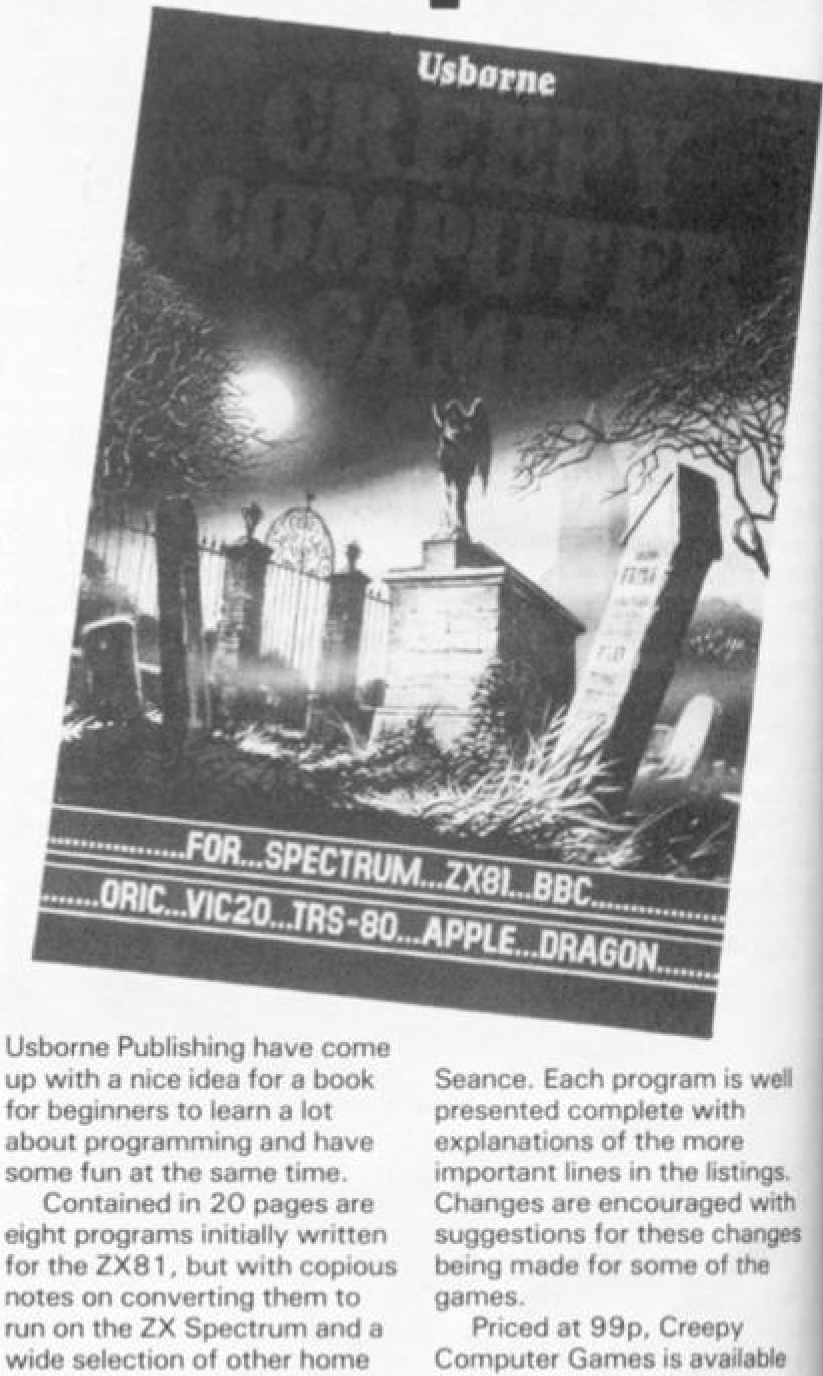
- From their new address in Worcester, Chalksoft have released a new range of tapes for the ZX Spectrum. Amongst the new collection are Eiffel Tower, which tests your knowledge of French vocabulary; Note Invaders, which help you to read music the 'invaders' way; Pirate, an inventive adventure game; and Spanish Gold, a multi-choice story book on-screen. Chalksoft have also undertaken conversions of most of their other educational tapes for the 48K Spectrum, so you could also ask about them when you talk to them on 0905 55192. Written enquiries should be addressed to 37 Willowsea Road, Worcester WR3 7QP.

- Specialists in management and accounting software,. Understanding Ltd, have launched a version of Corplan, the popular management game for the Spectrum. Used as a teaching and training aid from 'O' to 'A' level to management level in schools and colleges, you can find out more about this package from Understanding Ltd, 100 Cricklewood Lane, London NW2 2DS. Telephone enquiries can be made on 01-450 1144.

- If you've ever fancied a quick game of darts on your computer, now's your chance with this new piece of software called Championship Darts from Shadow Software. Based on the Spectrum and priced at £5.50, you can find further details from Shadow Software, Custom House, 17A Rawmarsh Hill, Parkgate, Rotherham, South Yorkshire S62 6DP. Enquiries by telephone should be made on 0709 527534.

- John Wiley & Sons Ltd have announced that they are about to start distributing the Sulis range of educational software, much of which is designed for the ZX Spectrum. The first packages available will cover aspects of the English language, including grammar, spelling, pronunciation, sentence construction and vocabulary. Forthcoming packages will range over a variety of subjects including History, French and English Literature. For further details get in touch with John Wiley & Sons Ltd, Baffins Lane, Chichester, Sussex PO19 1UD or 'phone 0243 784531.

Computer 'creepies'



Usborne Publishing have come up with a nice idea for a book for beginners to learn a lot about programming and have some fun at the same time.

Contained in 20 pages are eight programs initially written for the ZX81, but with copious notes on converting them to run on the ZX Spectrum and a wide selection of other home computers.

Amongst the titles included in Creepy Computer Games are Computer Nightmare, Ghost Guzzler, Mad House and Seance. Each program is well presented complete with explanations of the more important lines in the listings. Changes are encouraged with suggestions for these changes being made for some of the games.

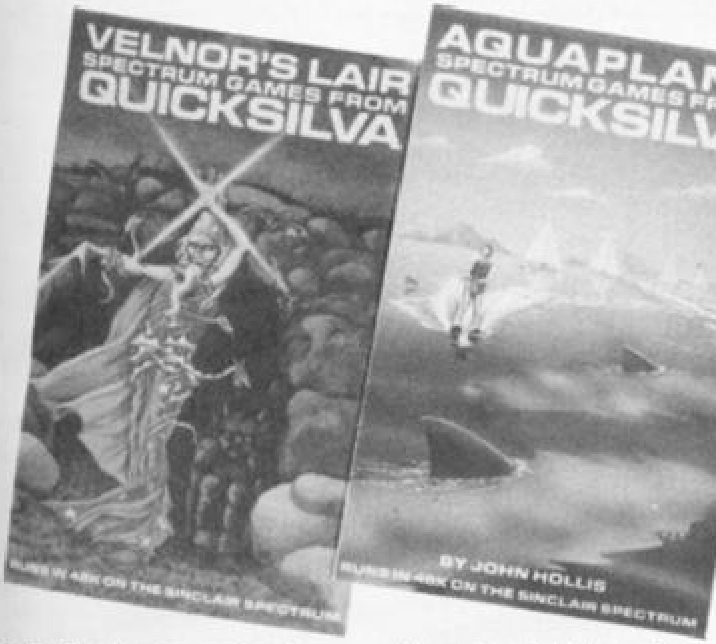
Priced at 99p, Creepy Computer Games is available from your local computer bookshop. For more details you could always contact Usborne Publishing, 20 Garrick Street, London WC2E 9BJ.

Transform Your Business

Nearly two years ago, Transform Ltd purchased a ZX81 for preparing accounts but finding no suitable software on the market decided to write their own. After meeting with success, they decided to offer their software to other companies — it is now established in over 300 companies in the UK and abroad.

Among their titles for the 48K Spectrum and the 16K-64K ZX81 are Business Bank Account, Purchase Day Book, Sales Day Book, Quarterly Analysis and Sales Cash Day Book. Programs for the 48K Spectrum include

Secret Software



Quicksilva have organised a secret hideaway for two — purely so they can get away from the day to day business matters and get down to some serious software writing. Busy on the top floor of an office block in a small Hampshire village, Quicksilva's technical director, John Hollis, and the company's chairman, Nick Lambert, are now concentrating their efforts on a new range of software — it will be interesting to see what comes of this isolation.

Meanwhile, Quicksilva have released a new range of software for the 48K Spectrum — five in all. There are two adventure games in the new selection: Velnor's Lair, which is a 'D&D' type program where you get to be a wizard, warrior or priest; and Smuggler's Cove, in which you have to search for treasure in an unknown cavern.

Of course, there are a couple of arcade-style games included in the new Quicksilva package — Aquaplane and Xadom. Aquaplane, written by Time-Gate author, John Hollis, involves you steering a speed-boat complete with water skier through stretches of water which seem filled with all manner of obstacles in the form of logs, sailing boats and sharks! The other game, Xadom, is a 3D adventure in which you cross swords with such creatures as Num Skulls, Vambats and Cybots.

The last game is called 3D Strategy and will operate on both the 16K and 48K Spectrum. Based on the popular naughts and crosses game, this machine code only program is based on a four by four by four cube.

Quicksilva, in conjunction with Salamander, have also taken on the task of marketing Jeff Minter's Awesome software range, including Gridrunner, Matrix and Attack of the Mutant Camels, for the Spectrum. There is also furious activity taking place to launch the first of this new range, a game called Traxx.

For more information on the new Quicksilva range, get in touch with Quicksilva Ltd at Palmerston Park House, 13 Palmerston Road, Southampton SO1 1LL or 'phone 0703 20169.

Stock Control and Invoicing (also available for the 16k ZX81) and Wages Records.

While the software was originally written for small businesses, Transform have been asked by many of their clients to update the software to accept invoices of over £99,999.99 — which only goes to highlight the potential of ZX micros in business!

For further information on these competitively priced products you can 'phone Transform on their 24 hour answering service on 01-658 1661 or their new office telephone number, 01-658 6350. Of course, you could always write to them at Transform Ltd, 41 Keats House, Porchester Mead, Bechenham, Kent.

Manic On Your Micro?

Following their recent move of premises, Bug Byte Software have leapt back into the fray with five new games for the ZX Spectrum.

For the 16K/48K Spectrum there are three new titles, The Castle, Aquarius and Pool. First up is The Castle, an adventure in which you wake up with one of those 'whatever did I do last night?' headaches to find yourself in a deserted castle with the task of searching for treasure. Needless to say, the castle is full of all sorts of 'nasties' which try and stop you fulfilling your quest.

The second game is called Aquarius and places you as commander of a frogman team. Your task is to destroy the enemy's death machines which they have hidden in underwater caverns protected by sharks, mines, jellyfish, strangleweed and the like. The last game for either version of the Spectrum is Pool, an adaptation of the popular table game.

For the 48K Spectrum, Bug Byte have made the curious choice of introducing a General Election program in which you have to win more seats (100 in all) than your opponent. It seems a shame the game could not have been released to coincide with the real thing — but then just think how much experience you'll have by the time the next general election comes round!

Last, but definitely not least, comes Manic Miner. In this delightful game, you play Miner Willy who must make his way through 20 different levels while trying to keep out of the grasp of robots, killer turkeys, mutant telephones, kangaroos and malevolent toilets. And if that sounds fantastic, just wait until you've actually tried the game for yourself! Bug Byte claim you have to see Manic Miner to believe it — they're not far wrong either.

The prices of these packages are all £5.95, except for General Election which will retail for £6.95. For further information on the new range of Spectrum software contact Buy Byte Software, Mulberry House, Canning Place, Liverpool L1 8JB or telephone 051-709 7071.

It's An Education

Available now is the first phase of Longman Software's software program for children in the four to eight year age group. Three titles, Countabout, Hot Dog Spotter and a, b, c . . . Lift Off!, will be marketed at £7.95 each for the 16K/48K ZX Spectrum

The aim of the programs is to turn learning activity into a friendly game. Each program comes complete with Parent's Notes, which comprises six pages of instructions explaining the use of the program, as well as suggestions for extending the learning.

The first program, Countabout, is a game introducing simple addition for children aged between four and six years old. A number of coloured objects move onto the screen and the child must either add or subtract to achieve the correct number. If the child inputs the correct answer a monkey is seen to climb a tree to win a bunch of bananas.

The Hot Dog Spotter is a game of speed and skill which teaches number recognition and response to children aged four to eight years. In this game a coloured ball with a number of dots drops down the screen and the child must input the correct number of dots for the ball to be seen to bounce back up the screen.

The last game in this selection is called a, b, c, . . . Lift Off! and provides a pictorial introduction to the alphabet and word-recognition for four to six year olds. The program consists of two sections, the first illustrating a picture alphabet with 26 computer-graphic images in full colour representing each letter. The second section comprises a game in which children must match up an alphabet image with a correct word.

For more information on these packages, write to Longman Group Ltd, Longman House, Burnt Mill, Harlow Essex CM20 2JE or 'phone 0279 26721.

Hardware .... In Brief

- Spectrum users can now access the full range of information and facilities on Micronet 800 via the Prism VTX 5000 viewdata modem. Specially designed to fit under the 16K/48K Spectrum, the unit offers the convenience of direct connection via the telephone line and on-board terminal software contained in ROM. Retailing at £99.95, you can find out more information from EMAP Business and Computer Publications Ltd, Durrant House, 8 Herbal Hill, London EC1 5JB.

- Next Computer Systems are operating a ZX81 repair service attempting to get the repaired computer back to its owners within a week. There is a basic charge of £15.95 excluding postage but this could, of course, increase if you incur damage to the pcb or the ula. Senders should enclose a brief report of the fault but should refrain from sending the PSU with the computer. For more details contact Next Computer Systems, 88 Harvest Road, Englefield Green, Surrey TW20 0QR.

- New from Petron Electronics comes the Trichord, a plug-in music and sounds peripheral for the Spectrum and ZX81. Using the AY-3-8910 programmable sound generator together with a PROM which holds the data for a variety of sound effects and a basic octave of notes which is used by the Music program supplied on cassette. Priced at £24.95 and £26.95 for the ZX81 and Spectrum versions respectively, you can find out more about the Trichord from Petron Electronics, Courtlands Road, Newton Abbot, Devon TQ12 2JA or by telephoning 0626 62836.

- Technology Research Ltd have announced the availability of a floppy disc interface card for use with the Spectrum which will work with any Shugart standard disc drive or with the new three inch Micro Disc 1 drive. Further details are available from Technology Research Ltd, 57 Brockley Rise, London SE23. Telephone enquiries can be made on 01-699 5332.

- Available from Addpac Electronics is the Addpac JS11 joystick and interface for the Spectrum. Complete with demo program, this package is priced at £18.99 all inclusive. For more information get in touch with Addpac Electronics, 22 Watling Street East, Towcester, Northamptonshire NN12 7AF.

- Cheetah Marketing Ltd have developed a speech synthesis module for the Spectrum and ZX81. Designated the Sweet Talker, it is built into a robust case which simply plugs into the user port of the micro. There is no need for an additional power source and the Sweet Talker incorporates a speaker unit which is set at an optimum level. Supplied with a demo tape explaining how the unit is best used (along with a chart for easy reference), the unit is priced at £34.95. For more details on Sweet Talker get in touch with Cheetah Marketing Ltd, 359 The Strand, London WC2R 0HS or telephone 01-240 7939.

- A Time Controller has been introduced for the ZX81 and Spectrum computers. Consisting of a battery backed real time clock with eight programmable inputs and eight programmable outputs, the clock provides the computer with the month, day, date, hours, minutes and seconds. Utilising a built-in program in PROM, only a single instruction in the user's program is required to read or write the time or date. The recommended retail prices for these devices for the ZX81 and Spectrum are £34.50 and £38.50 respectively. Further enquiries can be made to Glanmire Electronics Ltd, Westley House, Trinity Avenue, Bush Hill Park, Enfield EN1 1PH or 'phone 01-366 3245.

Taping Troubles?



Elinca Products have announced the launch of a tape loader for use in helping you load and save programs to tape from the ZX81.

The ZX Tapeloader filters and stabilises signals in both directions, providing a constant signal perfectly matched for the computer. The new unit incorporates an audio output indicator and signal amplifier to enable the correct computer input signal to be used. It also filters out any unwanted signals and hum from the tape recorder.

Plugging and un-plugging leads is also not necessary when using the ZX Tapeloader to load and save. There is a switch on the unit which you can turn either to 'save', 'off' or 'load'.

The manufacturers of the unit claim the unit is especially useful solving taping difficulties, especially when so many software houses are using high speed duplicating machines which do not always give a steady signal.

Further details on the ZX Tapeloader are obtainable from Elinca Products Ltd, Lyon Works, Capel Street, Sheffield S6 2NL. You could always 'phone them on 0742 339774.

That's Handy, Tandy

Softest have introduced an interface linking either the Spectrum or ZX81 with the Tandy for colour printer plotter, CGP-115. Priced at £35.00, the interface includes connectors, leads, software on cassette and instructions.

The Tandy semi-intelligent printer both prints and plots under program control using four pen colours, red, green, blue and black, giving a good print quality. A wide range of print sizes are available under program control with the added facility of overprinting in different colours.

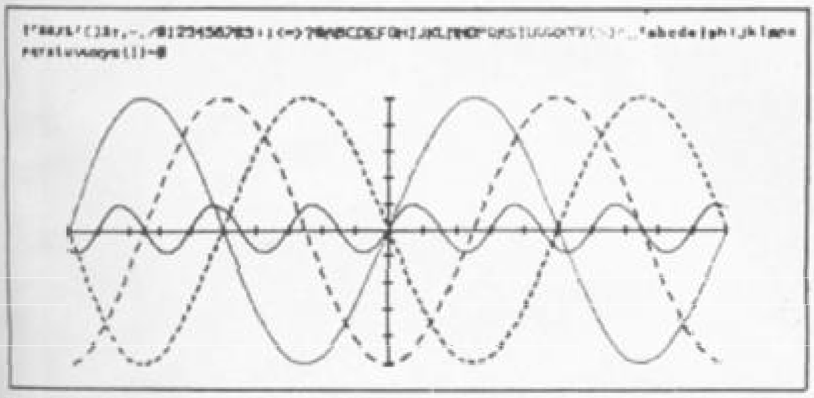
In addition to printing text at 12 characters per second, the printer can also be used for graphic material having an effective plotting range of 96mm on the x-axis divided into 480 steps with no limit on the y-axis.

The Softest hardware/software interface comes as a complete package designed to cope with the 'handshake' protocols between micro and the printer, with a set of machine code device drivers to control the movement of the pens. High level packages

which are supplied allow listing of BASIC programs between line numbers and use of printer control codes.

With this package, you could, for instance, print text, plans, drawings, pcb layouts, graphic presentations, charts and oversize lettering. The screen copy package allows the screen data to be copied onto the printer.

More information on this interface package is obtainable from Softest, 10 Richmond Lane, Romsey, Hants SO5 8LA.



A New Type?



Dean Electronics have introduced a new style printer to the UK market called the Alphacom 32. Priced at £99.95, you will no doubt spot the similarity to the American version of the Sinclair printer — this is no accident as the Alphacom 32 is made by the same manufacturer as that of the Timex-Sinclair 2040 Printer.

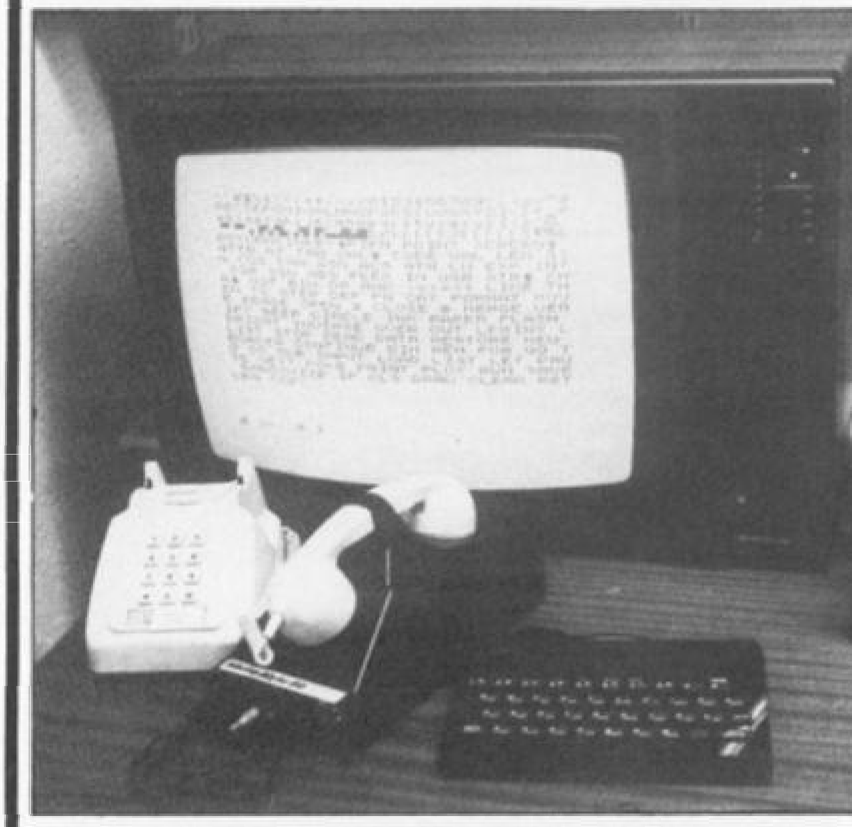
The new printer can be used directly with both the Spectrum and ZX81; a through port is provided allowing you to use a RAM pack if you are using a ZX81.

Using 4¼ inch wide thermal paper roll, the Alphacom 32 prints at the rate of two lines per second. The units have a built-in interface which accepts the standard Spectrum and ZX81 keywords, such as COPY, LLIST and LPRINT, and will also print user-defined graphics. Each unit has a self-test mode and paper advance button fitted as standard.

Replacement paper rolls are priced at £1.00 per roll plus P&P and are 25 metres long.

For more information on this printing alternative, contact Dean Electronics Ltd, Glendale Park, Fernbank Road, Ascot, Berkshire or telephone 0344 885661.

Acoustic Add-on



The Micro-Myte 60 acoustic modem, priced at £48.00, provides a low cost means of communicating information between compatible micros utilising the normal telephone network.

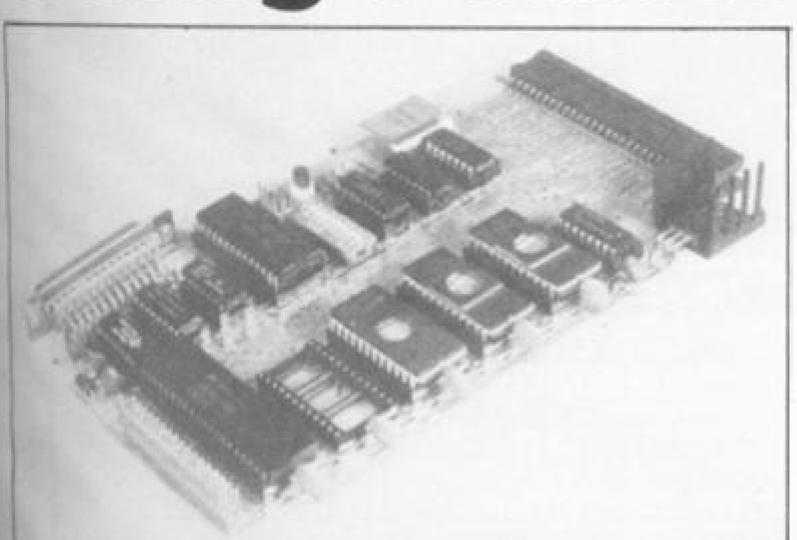
The modem is acoustically coupled to the telephone lines simply by strapping the handset into the modem cradle. The unit has been designed such that no special interfaces are required, the modem being connected to the cassette input/output sockets of the 48K Spectrum or the ZX81. Thus, the modem in no way interferes with any add-on devices, such as RAM packs, etc, you may already have connected.

The menu driven software is user friendly and allows for transmission of either complete programs, defined areas of memory or complete screen contents.

The modem comes complete with interconnecting cables to the computer power supply (no independent power supply is required), the software needed to operate the modem, instructions and a 12 month warranty.

For more information on the Micro-Myte 60 contact Micro-Myte Communications Ltd, Polo House, 27 Prince Street, Bristol 1 or telephone 0272 299373.

Going FORTH



A ROM cartridge containing 12K of fig-FORTH, a full, RS232 interface via an 8251, and 24 bits of parallel I/O via an 8255, is now available from David Husband's company, Skywave Software.

The BASIC ROM is switched out and replaced by the FORTH ROM, which contains all the standard fig-FORTH words and in addition offers a great many other features. Amongst these features are a Z80 assembler for machine code FORTH definitions; a built-in terminal to support a modem and allow access to bulletin-board systems; a machine code monitor which can operate in any number base, carry out simple one-line assembly and disassemble; RS232 and Centronics printer routines, usable from FORTH or BASIC; RAM disc simulation and support of Microdrives; and full use of colour, sound and graphics facilities from FORTH.

Produced on a PTH pcb, the cartridge has a standard DB25 RS232 connector for the serial I/O and a strip cable connector for the parallel I/O. The cartridge is suitable for both 16K and 48K versions of the ZX Spectrum.

Complete with an extensive manual, the price of the unit is £49.95. For further details get in touch with Skywave Software, 73 Curzon Road, Boscombe, Bournemouth or telephone 0202 302080.

Club corner



ZX Club

Dear ZX Computing,
We're the best ZX users' club in Spain producing a monthly newsletter of around 30 to 40 pages. We also teach BASIC in free weekly classes.

The club meets every day between 6 and 7.30 in the evening, and we interchange programs. For more information write to me at the address below.
Yours faithfully,

C. Benito,
PO Box 3253
Madrid,
Spain.

Staines and Stanwell Computer Club

Dear ZX Computing,
Our club has now been going for over a year, and has recently started exhibiting at ZX Microfairs. The club offers discounts on many products and reduced entrance prices to exhibitions.

The club boasts many well-known members including Clive Gifford, author of 'Making the most of your Dragon 32'. We would welcome any new members, with Sinclair Research machines or any other.

We usually meet once a week at Stanwell School, Short Lane, Stanwell. However, at the moment we have broken up the club during the long school holiday — but we'll be back with a vengeance in the first week of September.

For more details of the club, give me a ring on Ashford (69) 50313.
Yours faithfully,

Peter Shaw,
Stanwell,
Middlesex.

Penrith Area Independent Computer Club

Dear ZX Computing,
Forsaken by Prestel and desperately short of dealers, the Penrith area of Cornwall now has an up and running computer club.

PAICC (as we have abreviated it) hopes to change all that neglect. The club is non-profit making, non-aligned, and aimed at both the professional and amateur user. Its goal is to promote computer literacy in the area and to stimulate the use of computers in local education.

The PAICC Founding Committee includes representatives for women, local industry, education, business applications and home users.

The club is at present meeting every Friday in a well-equipped room above the Penzance Micro Centre, which has allowed the club access to some of their equipment and use of part of their premises.

PAICC is fully affiliated to the ACC and prospective members should 'phone one of the following: Steven Ericsson Zenith on Hayle 754845, Paul Whitehead on Penzance 66336 or Miss Millage on Sennen 500.
Yours faithfully,

Steven Ericsson Zenith,
Hayle,
Cornwall.

East London Amateur Computer Club

Dear ZX Computing,
The East London Amateur Computer Club meets on the second and fourth Tuesday of each month in the main hall of the Harrow Green Library, Leytonstone. Meetings start at 7pm and visitors are welcome.

The first meeting in the month is usually a talk about microcomputers, and the second meeting gives members a chance to discuss problems, ideas and programs. Micros of all types are represented, including Sinclair Research machines.

On the last Thursday in the month we have a special meeting for user groups, and a lecture on BASIC for beginners.

The current membership fee is £5.00 a year, half price for juniors and pensioners. Anyone interested in learning more about our club should ring the chairman, Fred Linger, on 01-554 3288 or myself on 01-558 3681.
Yours faithfully,

J. Turner,
London E11.

Spectrum User Club

Dear ZX Computing,
I haven't seen any Spectrum User Clubs anywhere in my area, so I've decided to start my own with the help of a friend of mine.

It will cost £4.60 a year to join, and in that year members will receive six issues of our magazine — one every two months.

For more information write to me at the address given below.
Yours faithfully,

Mark Burnett,
24 Inverness Drive,
Ilford,
Essex.

Belfast User Group

Dear ZX Computing,
A friend and I would like to start up a club for home computer enthusiasts in Belfast. The trouble is that we don't know how to start getting in touch with like-minded microcomputer owners in our area.

I'd be very grateful if you could print this letter asking anyone who's interested in starting such a club to write to me at the address below.
Yours faithfully,

F.J. Hughes,
11 Willowfield Street,
Belfast BT6 9AU.

Byte Home Computer Club

Dear ZX Computing,
I am writing to tell you of a multi-user Home Computer Club we have just formed for the whole of the South Avon district.

I will supply interested readers with further details if they write to me at the address given below.
Yours faithfully,

Valerie Boyde-Shaw,
Secretary,
Byte Home Computer Club,
7 Riverway,
Nailsea,
Avon BS19 1HZ.



If you run, or are a member of a user club which caters for the Sinclair user, why not get your group on the map by writing to us at:

Club Corner,
ZX Computing,
145 Charing Cross Road,
London WC2H 0EE.

All you have to do is to send us a letter with details of your club's activities (times of meetings, addresses of who to contact, etc) and we'll do the rest. If you publish a newsletter or club magazine, we'd very much like to see that too.

And if you don't see a club in your area, why not start one up by writing to *ZX Computing* and seeing if any like-minded enthusiasts wish to join you.

The ZX81 soft selection

Nick Pearce takes a look at some of the latest software available for the ZX81.

Moonlander — Orion

Moonlander is a simulation-type program and the first software release from Orion. The object of Moonlander is to get your landing craft from its orbit with the mothership 120 miles out in space and land safely on the planet surface. This must be accomplished using a strictly limited amount of fuel with which to control your descent and execute final touchdown manoeuvres.

There is an initial 60 second orbital countdown period after which you automatically unlock – if you have not already done so manually. The Automatic Gravity System (AGS) controls your descent rate from T + O to about T + 120 seconds with 10 second burn sequences and takes you to within about five miles of the planet surface. You can select to switch to manual override at any time during this descent but at T + 120 seconds you *must* take over. At 200 feet or below, the display is switched automatically to the Inter Orbital/ Relay scan for final touchdown.

During the simulation, the television screen displays the appropriate monitors and scans. Essential information such as elapsed time, height above planet, speed (of descent, but if you overdo the retroburns you can find yourself going back up!) and quantity of fuel remaining is given. The trick is to use just the right amount of fuel to descend quickly but in control to the planet surface; it is all too easy to run out of fuel, or misjudge your speed, and crashland. Helpfully, there is a touchdown practice routine.

Variations in the initial factors ensure that each mission is slightly different. Success takes practice and a soft landing is entirely dependent on pilot skill.

Moonlander is written in BASIC. I found the instructions somewhat jargonistic and difficult to understand, but once I had worked out how to operate the simulation and mastered the various monitor and scan displays, I found it quite a challenge. It certainly isn't easy to get that darned moonlander down without creating a new crater in the lunar surface. Just one more go should crack it . . .

Moonlander costs £4.95 and is available from Orion, Pippbrook Mill, London Road, Dorking, Surrey.

ZX Monopoly — MPT Software

As the name suggests, this program is a simulation of the popular board game. If you enjoy 'Monopoly' but cannot find an opponent, you can now play against your trusty ZX81.

This program is also written in BASIC and is quite long, taking 6½ minutes to LOAD – at least you don't have to lay out the board and distribute the money. The computer is banker so no chance of cheating I'm afraid.

As in the real game, you first select your piece, and the computer chooses one. In the main, play observes the usual 'Monopoly' rules, although there are a few variations (for example, there are hotels but no houses in this simulation). There is no board display; at each turn the screen indicates the player's financial situation, current board position, a list of title deeds held, and a choice of options. The computer rolls its own, and your, dice.

Because you are not physically using a board and pieces, and since the computer as banker does all the necessary arithmetic quickly and accurately, a game against the ZX81 is usually over much more quickly than a game against human opponents. The cassette is recorded on both sides and comes complete with a printed sheet of instructions.

This simulation has been well thought out and works well. It certainly takes an alternative approach to Workforce's Do Not Pass Go for the ZX Spectrum (reviewed in the June/July '83 issue of this magazine) in which the computer replaces the board and pieces for two to six players, but does not play itself.

In my opinion, however, one really would need to be a fanatic 'Monopoly' enthusiast to obtain much pleasure from playing against a computer; one of the great joys of board games of this sort is the social contact that they engender.

If you do want to play against your ZX81, this cassette seems good value for money and its author is promising to offer a free 16K arcade game to all purchasers.

ZX Monopoly costs £3.00 from MPT, 42 Raedwald Drive, Bury St Edmunds, Suffolk.

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HAT    TO PLAY
HAT    HAS £1518
CURRENTLY ON FLEET STREET
HAT    HAS THE TITLE DEEDS TO:-
TITLE                    VALUE
PENTONVILLE RD            120
FLEET STREET              220
YOU HAVE A CHOICE OF:-
1.THROW DICE
2.BUY HOTELS
3.SELL A SITE OR HOTEL
4.LIST WHAT YOU CAN LAND ON
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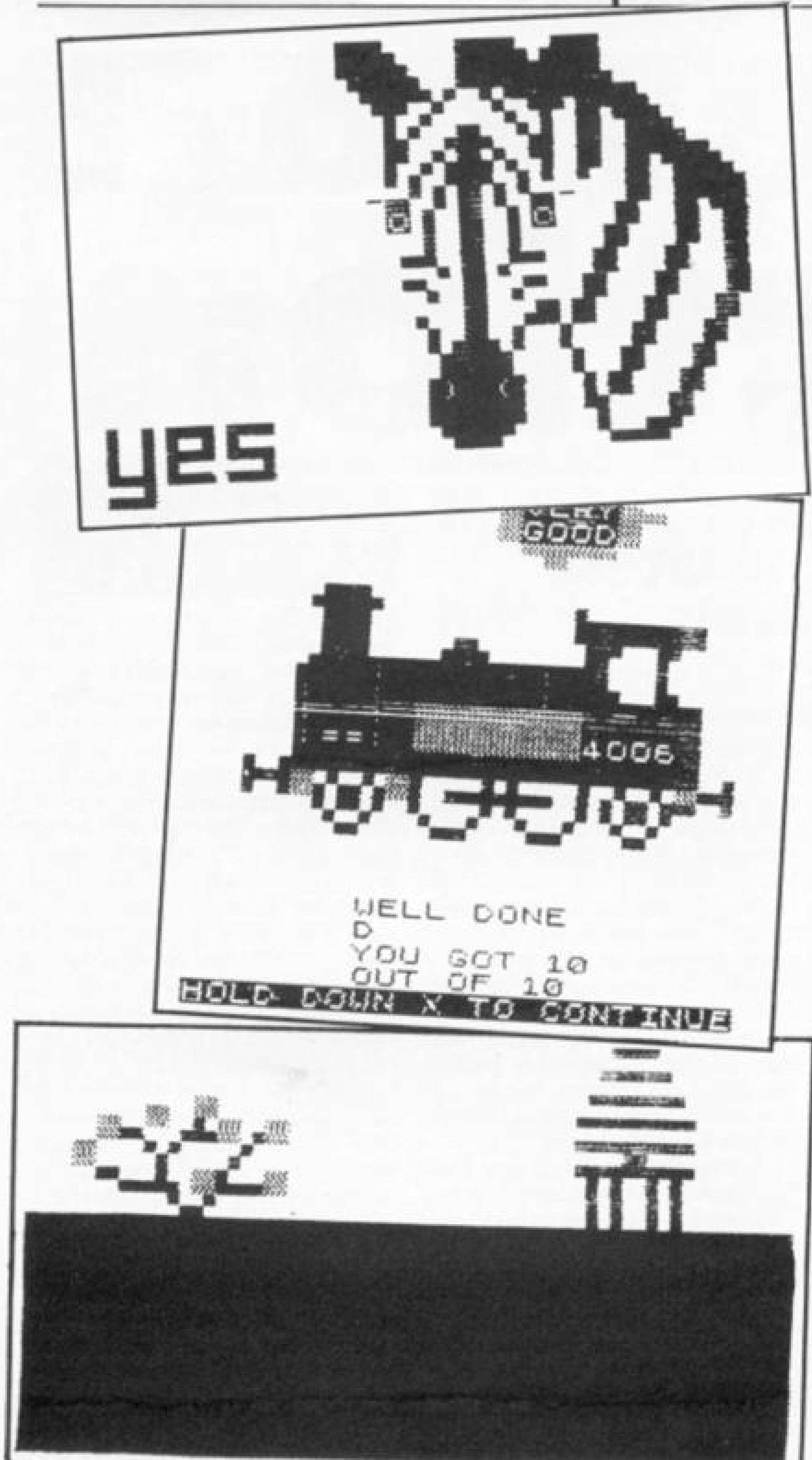
A screen illustration from the program, ZX Monopoly, by MPT Software.

Spelling Bee — Image

Spelling Bee is a recent release designed as a spelling aid for the young child. Forty pictures are used to elicit 100 spellings, which get progressively more difficult.

The use of graphics is a particularly impressive feature of this program. Some thought has been given to making the program user-friendly; for example, it asks for the child's name at the start and refers to the child by name during the spelling exercise. Although it claims to be an educational program for the very young, one does need to be able to read and write in capital letters to use this program – primary schools usually teach in lower case only, at least for the first couple of years. Some of the words are quite difficult too and I would have thought the seven to 10 age group would obtain the most benefit from this program.

There are 10 series (each containing 10 spellings) with five on each side of the cassette. Each series works by displaying a succession of pictures which the child must recognise and spell correctly. Only one word is accepted for each picture and the child is allowed two attempts and is given a 'yes' or 'no' as appropriate. After the second 'no' the correct word is displayed alongside the picture and the pro-



Sample screen illustrations from the program, Spelling Bee, by Image Systems.

gram moves on to the next object.

Spelling Bee is an exercise in recognition, and sometimes deductive reasoning, as well as spelling. Whilst the graphics are very good, they can be misleading – at first I thought the oven was a robot, and when I entered 'OVEN' I was told 'no', the correct response was 'COOKER'. Once familiar with the objects after the initial run through it does, of course, become solely an exercise in spelling.

After each series of 10 objects, the child is told the score achieved and is rewarded with an animated display of some sort.

Whilst the first two series involve simple object recognition, the others are somewhat more difficult because a '?' is printed over that part of the object on display which has to be spelled – it is not always clear what exactly is being referred to. The program has apparently been tested by Image at playgroups and among schoolchildren where it is claimed to have stimulated considerable interest.

Designed as a spelling aid, this program will also serve to provide a useful introduction to computing for youngsters. A very good program indeed.

For those with the facility, there is a version in 'Q-SAVE' code recorded on each side, otherwise the standard ZX81 version takes about seven minutes to load. The programs are in BASIC with some machine code.

ZX Spelling Bee costs £5 from Image Systems, 165 Elm Road, New Malden, Surrey, KT3 3HX.

Blockade Runner – Paul Gillet

In Blockade Runner, you control a blockade ring (a circle of inverse asterisks) which is depleted each time the runner (a '0') tries to break through. The object is to rotate the ring to block the runner and prevent it escaping through the spaces.

If the last blockader on the ring in sunk before the runner escapes, new rings are set up, and it is possible to build up a high score.

There are 10 speeds of play, the fastest requiring very quick reaction times indeed. A record of the current socre, and the highest score so far, is kept.

This is a competent machine code game which works well. However, it is not particularly sophisticated and I feel a few other games on the cassette are really necessary to provide more interest and make it a worthwhile buy. As it stands with just the one game it seems rather overpriced.

Blockade Runner costs £3.95 from Paul Gillet, 30 Cromwell Way, Kidlington, Oxford.

Three cassettes for the 1K ZX81 – Selec Software

Each of these cassettes contains two fast machine code games. They are all impressive considering the exceptionally small memory available on the unexpanded machine.

Unlike many 1K programs, all these cassettes load and run directly on 16K machines and there is no need to reset RAMtop. Apparently this is due to a software feature which converts the ZX81 display file into a true memory mapped VDU releasing extra memory as a consequence. Selec Software have certainly done well to get these very good games into 1K of RAM.

ZX Panic/ZX Squash

In ZX Panic the screen displays a field randomly and liberally supplied with electricity pylons. A killer virus has been released and you must spray as much of the field as possible with a poison to kill it. Once you start you are unable to stop and must avoid hitting the pylons, your own poisonous cloud or the edges of the field. Your score is displayed on screen.

ZX Squash is a simulation of squash for two players. Each player has a bat (or racquet) which is moved along the bottom of the squash court, and each in turn tries to hit the ball as it bounces off the court walls. The first player to reach 15 points wins. I would have liked the bats to move a little faster; as it is, the ball is often impossible to reach.

Maze Guzzler/Super Breakout

Maze Guzzler is a 'Pacman'-type game, with all the usual facilities found on the 16K versions available. Because of the restricted memory, the maze is rather small, and the action is perhaps rather slow, but does increase in speed as the game progresses. There are two 'intelligent' monsters which must be dodged, and dots to consume. There is even an energy pill which will allow you to chase the monsters for an additional 20 points – for a short while. On screen scoring is provided. Quite amazing for a 1K game.

Super Breakout on the B side is Selec's version of this popular game, of which there are already a number of 1K versions. The action is fast and responsive, although the display is not full screen.

Invaders/Time Bomb

A very good IK version of Invaders is on the A side. The action is as good as many 16K versions although again the limited memory has dictated a display which is less than full screen in size.

Time Bomb on the other side of this cassette is a frenetic game in which you have to reset bombs which appear randomly on the screen. The game ends when a bomb counts down to zero and explodes. As more and more bombs appear as the game progresses, it is only a matter of time before it becomes impossible to rush round and reset them all.

If you are in the market for 1K games, all these cassettes are to a good standard and are worth considering as a reasonably good buy. It is certainly surprising what can be achieved for the 1K ZX81 with a little ingenuity.

ZX Panic/ZX Squash, Maze Guzzler/Super Breakout and Invaders/Time Bomb cost £3.50 each from Selec Software, 37 Councillor Lane, Cheadle, Cheshire.

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sinclair special

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Inside...
Two special offers...
Six new software titles...
Microdrive!

Something for everyone, from Sinclair!

Welcome to another Sinclair Special. Even if you're not yet a Sinclair owner; I believe you'll find something of interest in this latest issue.

For instance, if you're looking for the best way to begin computing, turn to our back page. You'll see that leading Sinclair retailers are now offering the popular ZX81, complete with a 16K RAM Pack *and* a free software cassette, all for £45. That means savings of at least £29 on one of the world's all-time best-selling computers.

Those same retailers are also offering the ZX Printer at its regular price of £39.95, but accompanied by a *free* 5-roll Paper Pack, worth £11.95.

If you want to add even more speed and versatility to your ZX Spectrum system, you'll be pleased to hear that the new ZX Microdrive has now been officially announced.

Microdrives are being released on an order of priority basis. Spectrum owners who purchased direct from us will be sent order forms, in a series of mailings that begin with the earliest names on our list of Spectrum owners. If you didn't buy direct from us by mail order, send us your name and address (use the coupon in this Sinclair Special). We'll add your name to the list, and send you a colour brochure and details on how to order.

Finally, if you're looking for more ways to use your ZX system, take a look at the software opposite. There are programs for programmers, a space-chase and car race for arcade-game players, a brand new logic game for those who've exhausted 'the cube.'

The Cattell IQ Test is based on the definitive professional psychologists' test – and forms an accurate but easy way of measuring your own IQ. All the new programs are available direct from us, through the order form in this issue.

You'll see what I mean about Sinclair having something for everyone. And we'll have even more to show you at two forthcoming exhibitions: the PCW Show at the Barbican Centre, from September 28th to October 2nd, and the Great Home Entertainment Spectacular at Olympia, from September 17th to 25th.



Nigel Searle, Managing Director
Sinclair Research Ltd.

ZX Microdrive System preview!



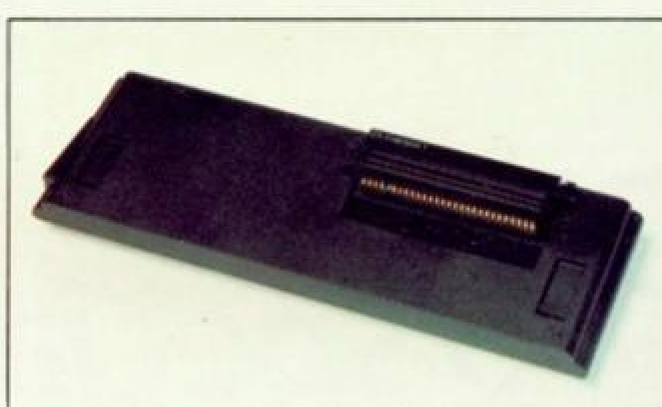
ZX MICRODRIVE

At least 85K bytes storage, loads a typical 48K program in as little as 9 seconds: £49.95.



ZX MICRODRIVE CARTRIDGE

Compact, erasable, revolutionary. Complete with its own storage sleeve. Contains up to 50 files, with a typical access time of 3.5 seconds: £4.95.



ZX INTERFACE 1

Necessary for sending and receiving information from ZX Microdrive. Includes RS232 interface and local area network facility for 2 to 64 Spectrums. Attaches to the underside of your Spectrum. Purchased with ZX Microdrive, just £29.95. As separate item, £49.95.

PSYCHOLOGY, GRAND PRIX RACING, BRAIN TEASING, PROGRAMMING, SPACE-BLASTING!

Sinclair have it all taped with six brand-new programs for ZX Computers!



Chequered Flag
For 48K RAM Spectrum. **£6.95**

Have you ever wanted to drive a Formula One car flat-out round a Grand Prix circuit? With Chequered Flag you'll need one eye on the road and one eye on the instruments, as you steer and brake to avoid hazards, and work through the gears in search of the lap or race record. This outstanding new program puts you in the driver's seat with stunning realism, and gives you a choice of three cars and ten different circuits. Don't crash!



Mothership
For ZX81 with 16K RAM. **£4.95**

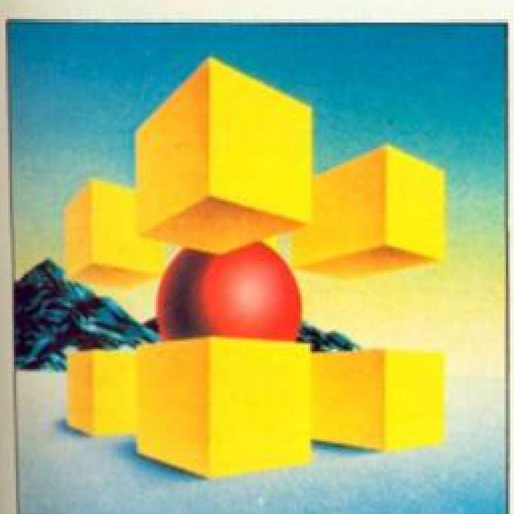
Scream down the claustrophobic confines of the Zarway. Engage suicidal drone fighters in deadly laser combat. Dodge, duck and dive in a high-speed 3-D race to attack the evil Mothership before she claims your home planet. Mothership is a truly tough challenge, and fast, furious fun!



Cattell IQ Test
For 48K RAM Spectrum. **£12.95**

Although there are a number of so-called self-administered IQ tests on the market, the only reliable way of finding your IQ has – until now – been to visit a qualified psychologist and take a battery of tests – for a fee. Now Victor Serebriakoff, International President of Mensa, has produced Professor Cattell's test in a form which enables you to use your ZX Spectrum to test your IQ.

The Cattell Scale IIIA test is timed by the computer, marked immediately, and the marks standardised against your age. This is the first time that an accredited, standardised test has been available to the general public.



Zeus Assembler
For 48K RAM Spectrum. **£12.95**

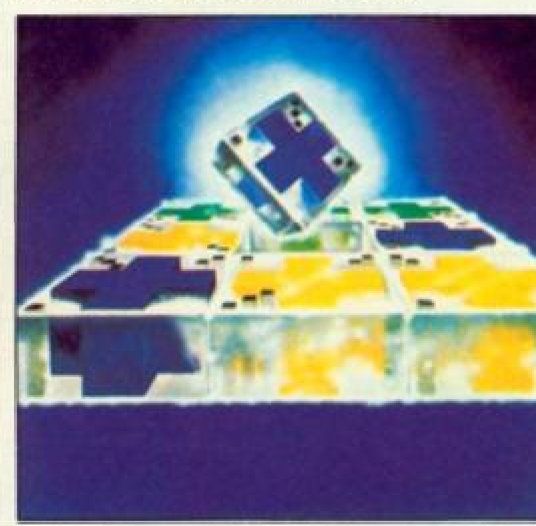
A powerful and easy-to-use programming aid, designed to simplify the entire process of producing machine code programs, enabling you to write in assembly language instructions. Comes complete with comprehensive range of support facilities.



Monitor and Disassembler
For 16K & 48K RAM Spectrums. **£12.95**

This powerful Disassembler translates machine code into comprehensible assembly language instructions, allowing you to examine the BASIC ROM, to investigate the workings of the Spectrum or to analyse your own machine code routines.

With the highly versatile Monitor, you get an extensive set of facilities to aid the entry, inspection, modification and debugging of your own machine code programs.



Flippit
For 16K or 48K RAM Spectrums. **£9.95**

Like those cube games, Flippit looks simple. But its fiendish ingenuity results in the ultimate game of logic and patience. Twist, turn and swap the nine Flippit pieces in search of the elusive magic square. But be warned, those pieces can be arranged in *millions* of combinations...

TWO SPECIAL OFFERS FROM SINCLAIR

STARTER PACK: £45



Powerful passport to home computing – now at the lowest price ever!

ZX81

Sinclair ZX81 – 900,000 sold so far. Touch-sensitive keyboard... black and white graphics... just plugs into most TV sets. With 212-page BASIC manual – step-by-step guide to the world of personal computing. Normal price £39.95.

ZX 16K RAM PACK

Gives the ZX81 more power – the power to run sophisticated software like Flight Simulation and Chess. Normal price £29.95.

CASSETTE

Worth £4.95 or more. In every starter pack, there's a top-flight 16K cassette – like Chess or Fantasy Games or one of the valuable education series. Actual title varies with availability. And once you own your starter pack, there are 37 other Sinclair cassettes available (plus dozens from other manufacturers).

Look for the special packs at WH Smith, Boots, John Menzies, Currys and other leading Sinclair stockists. Not available by mail order.

Offers subject to availability while stocks last.

ZX PRINTER AND FREE 5-ROLL PAPER PACK: £39.95



ZX PRINTER

Designed exclusively for use with the Sinclair ZX81 and ZX Spectrum personal computers. Printing speed: 50 characters per second. 32 characters per line, 9 lines per vertical inch. Plus graphics direct from screen. Now with a *free* pack of 5 rolls of special paper (normal price £11.95).

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Telephone: (0276) 685311.

How to order

Simply fill in the relevant section(s) on the order-form below. Note that there is no postage or packing payable on Section B. Please allow 28 days for delivery. Orders may be sent FREEPOST (no stamp required). Credit-card holders may order by phone, calling 01-200 0200, 24 hours a day. 14-day money-back option. ZX81 Starter Pack and Printer and Paper offers are not available by mail order.

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR.

ORDER FORM

Section A: hardware purchase

Qty	Item	Code	Item Price £	Total £
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	Postage and packing:	0029	4.95	
			TOTAL £	

ZX81 Starter Pack and Printer and Paper offers are not available by mail order.

Section B: software purchase

Qty	Cassette	Code	Item Price £	Total £
	FOR SPECTRUM			
	L4/S Monitor & Disassembler	4403	12.95	
	L3/S Zeus Assembler	4402	12.95	
	G26/S Flippit	4025	9.95	
	P1/S Cattell IQ Test	4500	12.95	
	G31/S Chequered Flag	4030	6.95	
	FOR ZX81			
	G26 Mothership	2125	4.95	
			TOTAL £	

Signature

*Delete/complete as applicable.

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £ ____

*Please charge to my Access/Barclaycard/Trustcard account no:

Mr/Mrs/Miss

Address

ZXC 910

(Please print)

ZX Microdrive information request

Please add my name to the Microdrive Mailing List, *and* send me a colour brochure with full specifications of ZX Microdrive/Interface 1 ☐ *(tick here)*. You can use the above form to send us your name and address.

Getting into print

If you've been frustrated by your printed listings, check out this new device from Euroelectronics with Simon Goodwin.

If you've ever spent hours puzzling over a smudged listing from a Sinclair printer then ZX LPRINT could be the device for you.

ZX LPRINT is a small black box, which plugs into the back of your Spectrum where a Sinclair printer would normally go. A socket on the back of the box allows you to plug in a lead linking the Spectrum to a quality dot-matrix or daisywheel printer.

The unit modifies the workings of the Spectrum ROM so that, while the box is connected, all the text which would normally go to a Sinclair printer goes to the quality printer instead. You can use the standard LLIST and LPRINT commands – the box will interpret them without the need to load special 'driver' programs to stop the computer trying to use the Sinclair printer format.

Essentially . . .

ZX LPRINT is made up of two essential sections – a 'parallel port' which allows the Spectrum to communicate with any printer equipped with a standard 'Centronics' interface. Most cheap dot-matrix printers use that interface, and consequently they can be directly connected to ZX LPRINT.

The second ingredient is a 'ghost' ROM memory, similar in principle to that used in the Microdrive interface. When the box is connected, it uses internal electronics to 'replace' part of the Spectrum's 16K ROM. The effect is that the parts of the ROM which used to deal with Sinclair's printer are replaced with machine code to work ZX LPRINT. The computer works just as normal, except LLIST and LPRINT are routed to the quality printer.

There are, however, a couple of potential snags. ZX LPRINT sends two signals to the printer at the end of each line – one to move the print head to the start of the line and the other to wind the paper on. Some printers automatically wind the paper as they move the head back, so that they give double-spaced printout with ZX LPRINT. There is usually a switch inside the printer to stop this happening, but it is a shame that the ZX LPRINT instructions do not mention the possibility. The instructions are actually printed on the back of the interface box, which means that they are rather short although at least you can't lose them!

Another snag is the way that ZX LPRINT treats graphics. All popular printers treat alphanumeric characters the same way, so that it is easy for LLIST and LPRINT to work correctly with letters and symbols. Problems come when you try to send user-defined graphics characters to the printer. You can't send those characters with the LLIST or LPRINT commands, since only a Spectrum printer would recognise them properly.

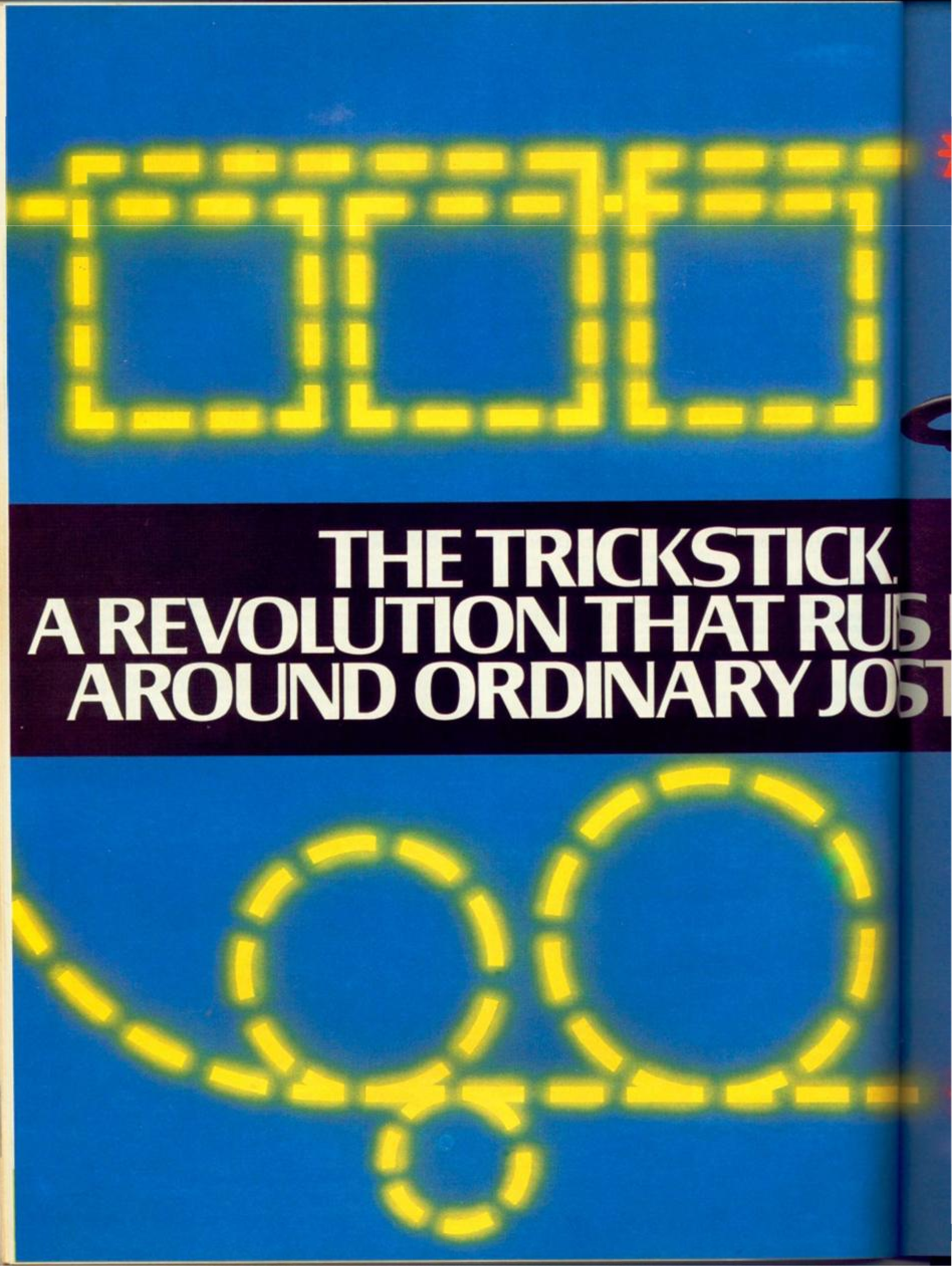
Almost every printer has a different way of coping with graphics, so that code to handle every variation of user-defined graphics and screen layout can't be built into the box. However, ZX LPRINT can recognise the COPY instruction. The makers supply cassette programs which allow you to COPY to most of the popular makes of printer, by loading appropriate machine-code into the Spectrum's reserved memory. ZX LPRINT will automatically use this code if it is present, allowing you to produce high-resolution dot-matrix screen printouts.

In the picture?

ZX LPRINT costs £41.40 including VAT, plus a rather high charge of £12.08 for a ready-made cable. The COPY software is available for most popular printers – each version comes with a demonstration tape which costs £5. The interface is made by Euroelectronics, Montpellier Retreat, Cheltenham, Glos.

At these prices ZX LPRINT is an expensive add-on for a Spectrum, but the price is fair considering the clever design and the cost of a printer to connect to it. If you're sick of 'space-age' Sinclair printouts and you can afford a quality printer, ZX LPRINT is an investment worth considering.




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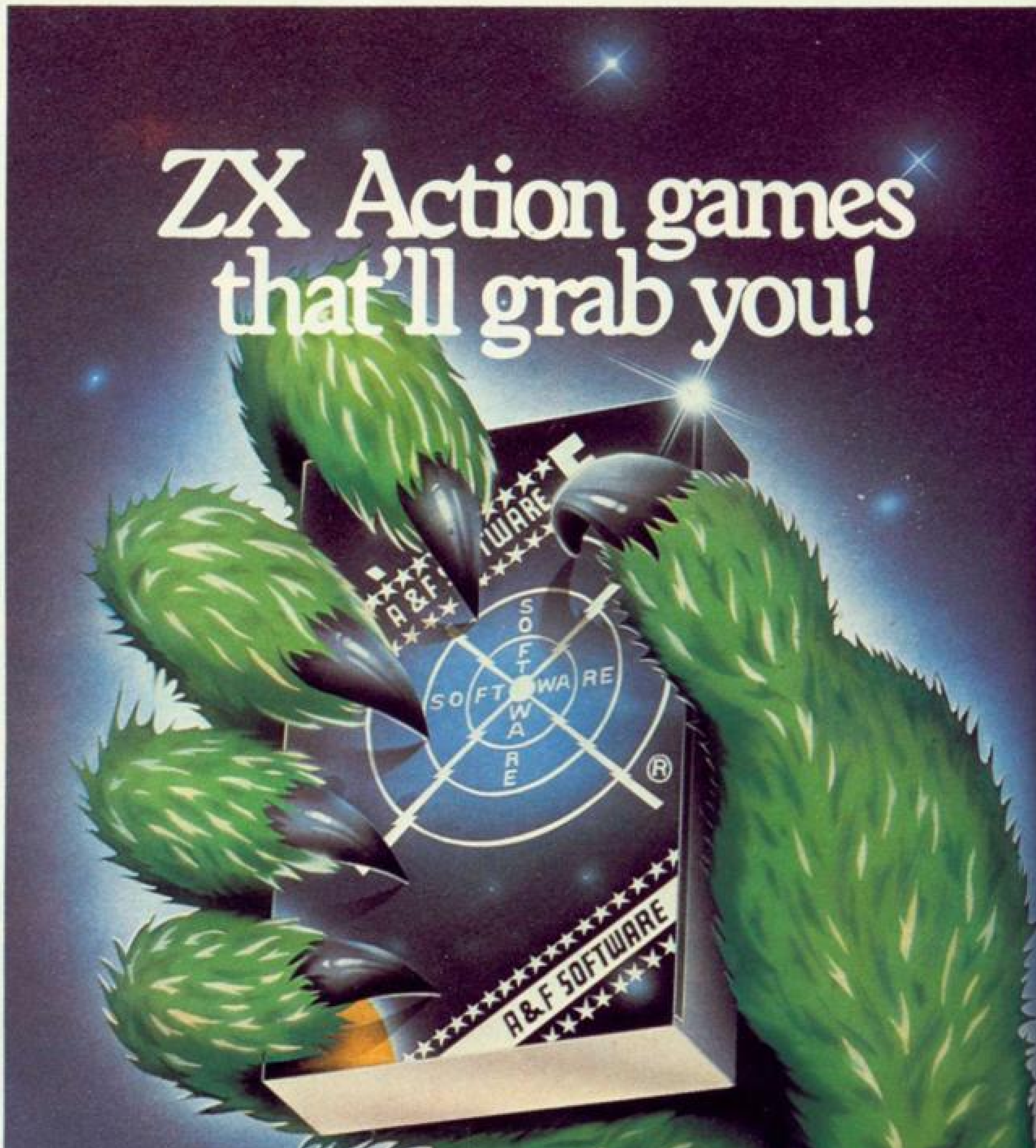
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Reader's reviews

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This feature provides you space to air your views on any software, be it for the ZX80, ZX81 or Spectrum. If you've had a good or bad experience with any of the commercial software packages available for your micro, why not write in and tell us?

Your reviews should contain your critical thoughts about the software and the relevant details concerning the availability of the package, its price, etc. You should aim to produce something like 250 to 500 words per package, depending, of course, on how enthusiastic you are about the software.

Any reviews published in this section of the magazine will be rewarded with the price of the tape you review. So, if you buy a cassette and send in a review which gets published, you'll get your software for free!

Love
Remsoft
Clive Gifford

Love is an adventure game set around a house with many rooms and relies on the player entering commands which are then acted upon. At this point, any similarities with other ZX adventures stop for this game is just for women!

The cassette comes with a detailed inlay card and leaflet explaining the story of the adventure and the basic instructions that you need to play it. Loading was perfect and the program auto-runs.

The main difference between Love and other adventures is that Love uses emotional responses as commands instead of the usual 'Go West' or 'Take Treasure' which are found in many adventures. These responses are classified into six groupings; communicative, such as talk; intimate, such as kiss; distressed, such as cry; happy, such as laugh; thoughtful, such as think; and cold and annoyed, such as scorn.

As well as the many emotional responses, there are a few system commands. These extra commands are very handy indeed and include 'SLEEP' which gets you out of any situation and back to your bedroom where you fall asleep and lose a day. 'FAST' and 'SLOW' are other system commands which alter the game speed and affect the screen presentation as they do in normal ZX81 programs. 'QUIT' allows you to end the game with the very useful option of SAVEing the position that you are in onto tape for a later date. This to me is a feature that all adventure programs should have as there is nothing more annoying than having to switch off and lose a good position in an adventure only to start at the beginning again at some other time.

The game is set round the infamous Poke Hall at the time of a large house party. Your aim is to fall in love as quickly as possible in the time you are there. Your only possessions in the early stages are a pair of pyjamas and a handbag. The odd assortment of guests include the Indian Mystic, Mr Ram Pac (what a pun), and your old friend Tom who you have secretly admired and loved for many years. You start the game in your own bedroom in Poke Hall on day one and must progress by use of the various commands, some of which you are told about and some you have to discover.

I played the game several times but my male chauvinist instincts must have impaired my chances as I got nowhere after several hour's play. I invited several girls to play the game but they faired no better and we all agreed on our conclusions that the game could get a little tedious. It does have some good things going for it such as its speed, which due to the small amount of machine code within the program is fast, and a vocabulary of over 200 words. Generally, this program is difficult to play and the responses to your commands and actions do not help you at all. I found the reply, 'I have no action for . . . (whatever I had just entered)', coming up nine times out of ten and your available options seem very few indeed. I tried everything imaginable and as a final protest typed in 'UNDRESS' which worked and left me naked.

On listing the program I found the number of locations and situations that you can find yourself in is a much larger figure than you would expect considering the limits of 16K memory. More importantly there is a clever plot underlying the whole adventure, and it is a pity that this cannot be better explained to the player before the game is started.

The program can be considered a 'clean' one for the family and at £5.00 is a standard adventure at a standard price.

Figaro II
Saxon Computing
Paul Holmes

At least, someone has answered my prayers. A program which is not only useful, but has good documentation and loads as well!

Figaro II is described as being a numeric database (although I would tend to call it a statistics projection program). For example, it can project next year's sales based on the sales figures for the year preceding.

Of course, there is more to it than that – Figaro II seems to do everything for the statistician. The documentation for this program is simply excellent, though I must say a few words about its cover. It is a fancy design comprising a lot of black lines that make your head spin!

Once inside the manual, however, the introduction soothes your aching eyes with an explanation of the program – how user friendly it is and what its limits are. Figaro II's system of analysis is based on a series of numbers such as sales figures for a shop for each month in a two year period. Each period (an individual number in a series) has a three character label for use in graphs (eg Jan, Feb, Mar, etc) and has a 10 character label for use in other circumstances.

The manual takes you through an example program before unleashing you on the program proper. To appreciate the flexibility of Figaro II at its full potential you'd probably have to be an Oxford mathematician, but luckily for us to use the program you do not. You can plot line graphs, bar charts, averages and a number of other statistical devices. A summary of all its features is given in the back of the manual. Also in the manual, they sensibly advise you to make a security copy and clearly explain how this is done.

This program has been well thought out and is a genuine serious applications package for the 48K ZX Spectrum. Figaro II is priced at £14.95.

Schizoids
Imagine Software
Martin Hanrahan

I bought this program on the strength of Arcadia, an excellent program, and also on the strength of the advertising which accompanied its launch.

The object, so the cassette insert says, is to manoeuvre your Space-Dozer around space, shunting refuse from one galaxy to another, into a black hole. Sounds easy enough, but the sides of your dozer are fragile and the black hole has a strong gravitational pull which seems to suck your dozer in towards the black abyss. The refuse comes in ▶

various shapes and sizes, spinning and hurtling through space – and all this in glorious 3D.

Loading the program was easy, it loads first time every time – if it doesn't load it is covered by a guarantee under which Imagine will replace the tape. The loading time was about five minutes.

A 'Schizoids' logo appears and asks you to press any key to begin. And this is where my first criticism arises. Your first glimpses of the program show a black screen with a circle in the middle with what looks like rays coming from it – this is the black hole. Below this is your dozer complete with a skyhook on the back for picking up refuse. Underneath the graphics are a clock (your score is measured by the length of time you survive rather than the amount of refuse you dump in the black hole – which is rather disconcerting), the number of ships you have (you start with four) and the highest time so far.

Then the refuse appears – cubes, diamond shapes, hexagons, rectangles and bars – all perfectly shown in 3D as they hurtle through space. When they touch the spikes of the black hole, they are sucked down and more refuse emerges onto the screen.

The keys for controlling the dozer are well thought out and are easy to use. The spaceship itself, however, is almost impossible to manoeuvre in the direction you want to go in and, once you've got the ship moving, because of inertia, is almost impossible to get it to stop and get under control.

The controls are left, right and thrust, but in place of a fire button you have a 'flip' control which turns your ship through 180°. The secret is to hit the refuse head-on and not let it hit the side of the dozer. The debris has a tendency to stick to the sides of the craft. Also, the craft sometimes seems to have a life of its own – but this may be part of the program.

While I enjoyed the game, I do not feel it has reached the high standard set by their previous effort on Arcadia. The program runs in 16K or 48K on a ZX Spectrum and is widely available for £5.50.

Test Match
Computer Rentals
Toby Braddick

The inlay card didn't fill me with confidence, but I decided to buy the game anyway. Side one contains a 'Test Match' program, with all the normal rules for a test match. The only thing missing is the 'Arlott-Trueman rabbiting' – did I hear someone cheer?

The game is initially set up as a match between England and Australia, the players being those selected for the last series – but you can choose your own teams quite easily. The game starts with the computer telling you which side has won the toss, the winner then elects to bat or bowl. The scorecard shows the eleven batsmen in order and the six elegible bowlers in order of ability. As the game progresses the card records the batsmen's scores, how out, extras, total score, overs bowled and full details of each bowler. Just like the real thing! The computer allows for 'bowler tiredness' so you can't use your best two bowlers all the time. Apart from the opening batsmen, you can bring in batsmen out of sequence if you wish to.

Once a bowler has been selected, you are presented with a three-dimensional view of the pitch and the bowler commences his over. The graphics show the bolwer running up to bowl, the batsman then plays a shot and the computer decides what will happen. You can be bowled, stumped or caught, or you might get 'byes', hit a boundary, be given the option of running or get a 'wide' or 'no ball' decision. If you have the chance to run and take it, the batsmen are shown running between the wickets and the fielder nearest the ball is shown running to field it to try and run the batsmen out. Some fielders are pretty sharp, while others don't seem too good until you decide to take a chance and they run you out with ease. Remember, it's a test match so don't be impatient.

The game allows declarations and follow-ons where appropriate, and in the last innings will show how many runs are required to win.

Side two contains a program for one day cricket, allowing a choice between 'John Player League' (40 overs), 'World Cup Series' (50 overs) and 'Prudential Cup' (55 overs). The game proceeds with the same graphics, but with different rules depending on your choice of competition.

I found these games enjoyable and exciting, proving to me that it's not the packaging that counts. They are also pretty realistic (England never seem to win!) – maybe I should have put Graham Gooch back in the team?

The price of this package is £5.95 and runs on the 48K Spectrum.

The Gauntlet
Colourmatic Computing
Jason Hardcastle

This game is a version of the arcade game 'Scramble' and is priced at (what I thought was quite a lot of money) £5.50.

The tape loaded easily and you are presented with a score table and a demonstration game so that you can get some idea of the action before you begin. If key '1' or '2' are pressed you get a one- or two-player option respectively.

In the game, which is somewhat similar to the arcade game except for the final stage, you get to fly your ship through various caverns watching out as you go for the enemy missiles and flying 'nasties'. If you hit the fuel dumps, the ship is re-fuelled. The graphics are good all round and the keyboard layout is well laid out. Not much luck is involved in this game!

My only complaint is that the bomb and firing keys are not auto-repeat – but this could be sour grapes because I get shot so often!

The game is hard to master and I have still yet to destroy one of the large fuel dumps in the last stage. The instructions supplied with the game are helpful and easy to follow, and the game itself is incredibly user-friendly.

As for the price of the game, I think it is worth every penny, and if you're as hooked on 'Scramble-type' games as I am and have a 16K ZX81 (and don't mind waiting six minutes for it to load) I would suggest you waste no time in buying it.

Krazy Kong
Personal Software Services
S Green

This program is one of the best programs for the 16K ZX81 I have ever seen. Costing only £3.95, it is a real value-for-money program.

The idea of the game is to jump over the barrels and fireballs dropped by a crazed gorilla at the top of the screen. In this version there are three different screens, each as hard as each other. The first stage, which is the same as the Arcade version, you are an inverse A, moved by the cursor keys, trying to get to the top of a steel structure by climbing ladders and outwitting the barrels and the fireballs, by jumping with the Break key. At first this is hard, but after some practice, the top can be reached easily. A bonus counts down until you get to the girl (an inverse J). At this point, you will receive the rest of the bonus. If your bonus runs out, you will lose a life, of which you have three.

When you press a key, the next screen will be displayed. This comprises conveyor belts, fireballs, inverse dollar signs (worth 200 points), and the girl. At this stage I wondered how I could get to the top, as I could see no obvious route. First, I climbed to the first conveyor belt, which promptly changed its direction, and dumped me into one of the fireball pits. Having one life left, I managed to get to the place where I thought I could go no further. I could see no route of jumping across to a conveyor belt, two character spaces away. I did not realise you could move and jump at the same time, I only thought you could jump into mid-air and back down again. But having overcome this problem, I waited until the conveyor belt was moving in the right direction, and managed to reach the girl after about 30 tries. Then the next stage . . .

You have to move around the screen, running over inverse colons (of which there are eight). This stage, by my reckoning, is the hardest. The fireballs are much faster than you, and if you jump over them, sometimes they come back and you land on them! If you run over a blank where a colon used to be, you will fall and die, but it is possible to jump over them. After practically hundreds of goes, I managed to complete this stage. After that, you return to the start, but everything is speeded up.

VU-3D
Psion
Alasdair Carter

The Sinclair software catalogue calls this 'a highly impressive modelling program' and in my opinion that statement is perfectly true. This

program allows you to create three-dimensional objects by drawing on the x and y planes and then creating the third dimension which is referred to as a z plane, and then you can view your object from any angle. On the reverse side of the cassette, an example of a wine glass and cube are provided to show what the program is capable of doing.

Also provided in the package is the most comprehensive set of instructions I have seen, consisting of a set of nine pages. The first page deals with the basic loading instructions which are common to most programs. The second page deals with the create mode which contains the instructions: OPEN, CLOSE, FIGURE, MAGNIFY, REDUCE, NEXT Z, QUIT, and the cursor movement keys. All the commands are performed by the first letter of the command being pressed, eg 'O' for OPEN and 'C' for CLOSE, etc.

Once the OPEN command has been used you can begin to draw. First you need to use the START command, and then a cross-hair appears on the screen showing the current position of the cursor; this is moved by the arrow keys and can be speeded up by pressing the Caps Shift key at the same time as the arrow keys. A line can be drawn by use of the LINE command (just the key L) and this will draw a point from the start position to the current position of the cursor. This can be repeated with the resulting lines being drawn from the last position of the cursor; previous lines can be deleted by pressing the 'D' key – however, this deletes one line at a time starting with the last line drawn and working back through the figure. To finish the figure, the 'E' key is used for the END command.

Then some 'depth' needs to be added to the two-dimensional object. This is done by pressing the 'N' key to operate the NEXT Z command. It may have been better if Psion had left the repeat facility on this key because it becomes a boring task to add up to 150 z-planes to an object. Whilst adding the z-planes, it is possible to enlarge or reduce the figure in the x/y plane so it can be tapered off to nothing or be larger than the original. You can then view the object after QUITing the create stage.

The display stage involves the commands: FAR,NEAR, MAGNIFY,REDUCE,QUIT, and use of the arrow keys. FAR or 'F' is used to retreat from the object to make it appear to be further away and this command also changes the perspective effect.

The NEAR command or 'N' allows the viewing point to be brought forward and, if advanced sufficiently, could be positioned inside the object. This command also changes the perspective effect on the object. MAGNIFY performs the same function as NEAR but it does not change the perspective. REDUCE performs the same function as FAR without changing the perspective. The QUIT command returns the program to the main menu.

The picture stage allows the user to choose how the object is represented. Three different options are available: HIDDEN LINE, SHADE and the normal wire-frame diagram. HIDDEN LINE removes all the lines from the wire-frame which would not be seen if the object was a solid. SHADE allows you to define a light source position and then the wire-frame is replaced by dots, the intensity of which varies depending on their position on the object in relation to the light source.

The MODIFY command returns the user to the creation stage of the program. Then the object in the x/y plane can be altered; however, this alteration also needs to be stepped through all the z-planes again.

The KEEP command allows a particular view of an object to be saved onto tape, so it can be retrieved again through VU-3D and enables you to add three-dimensional objects to your own programs, etc.

The SAVE command allows the whole data file which was created with the object to be transferred to tape for further use. This command also prompts instructions about how to save the program and what to do if an error occurs.

The colour of both the foreground and the background of the object and the commands can be changed by using the COLOUR command which allows any combination of colour to be used.

The PRINT command allows a hard copy of the object to be printed by a connected printer; however, using this command will sometimes crash the program if a printer is not connected, which results in all the data in the file being lost.

In my opinion, VU-3D is an excellent program which would be well suited to any person interested in three-dimensional design and easily justifies its price of £9.95.

Penetrator
Melbourne House
Steven Gray

"If you have a 48K Spectrum, then you must have PENETRATOR." So says the 'blurb' on the cover of this most amazing game. It is another version of 'Scramble', but with graphics rarely seen on a Spectrum. I must admit, I'm not an arcade fan, but having Penetrator has given me a better flavour of true arcade games. (I mean, 20p per game. It's silly!).

Even during loading, the graphics are stunning. The title page is an exact replica of the cover illustration. The code takes time to load (very poetic) but this time can be spent comparing the cover to the screen. When the loading is finished, pressing any key will present yet more stunning graphics in the form of a crescendo of coloured fireworks (I think) which rise and explode with amazing smoothness. After this, the program begins to draw (or write) the word 'Penetrator' across the screen in large joined-up letters. This can be speeded up by pressing enter. When this is done, the menu will be displayed.

The menu could be layed out better, however, giving some indication as to what keys should be used during a game. The options available are: one-or two- player game, training mode, edit mode, save or load a landscape, and disable sirens.

The one- or two-player game is self-explanatory and the training mode can place you in any of the five stages for a game with a number of lives (usually five). Edit mode allows you to design your own landscape and/or remove or add missiles and radars to your own ability. One flaw or 'bug' in the program is when you are on the return trip through the five stages (after bombing the neutron bomb store), the missiles which come onto the screen from the right tend to gather at the side. As overlapping missiles or radars automatically explode, all you need to do is control your ship through the tunnel. This is only a minor bug but it does rather take some of the fun away.

The next two commands on the menu allow your landscapes to be saved or loaded.

If no key is pressed during the menu then the computer will play a demo game (and very well, I might add) but does not recognise a customised landscape and so the ship crashes.

As I have said before, the graphics are stunning (even the radar dishes rotate separately!) and the edit facility makes game variations endless.

I need only mention one minor quirk and that is the control keys are difficult to master and no option for a joystick to be used is given. Having a joystick would improve the game greatly.

As it stands, the game is extremely good value for money and can really 'show off' the Spectrum to other, more expensive computers.

Penetrator is produced by Melbourne House at a price of £6.95.

For further information on these cassettes, you can write to the following addresses:

Remsoft, 18 George Street, Brighton BN2 1RH.

Saxon Computing, 3 St Catherine's Drive, Leconfield, Beverley, Humberside.

Imagine Software, Masons Building, Exchange Street East, Liverpool, Merseyside L2 3PN.

Computer Rentals, 140 Whitechapel Road, London E1.

Colourmatic Computing, 40 Longfellow Road, Coventry CV2 5HP.

Personal Software Services, 452 Stoney Stanton Road, Coventry.

Psion, c/o Sinclair Research, Freepost, Camberley, Surrey GU15 3BR.

Melbourne House Publishers, 131 Trafalgar Road, Greenwich, London SE10.

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Text is first arranged in 32 character lines for the screen with comprehensive editing facilities. On output the user simply chooses the line length required for printing and the system does the rest. Used with the Memopak Centronics Interface, the Word Processor makes available printout with 80 character lines, upper and lower case and single and double size characters.

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Memopak Memory Extensions

For those just setting out on the road to real computing, these packs transform the ZX81 from a toy to a powerful computer. Data storage, extended programming and complex displays all become feasible. Further details available on request.

16K Memopak £24.95 32K Memopak £34.95
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Z80 Assembler

The Assembler allows you first to code and edit a source program in the Z80 language, and then assemble it into machine code. You can now write flexible and economic programs. The Editor mode allows you to code directly in the right format, manipulate individual lines and control the exact placing of source and machine code. Routines may be merged or listed (even to a commercial printer using our Centronics Interface). The assembler mode handles all standard Z80 mnemonics, numbers in hex or decimal, comments and user-selected labels.

£29.90 inc. VAT



Memotech Keyboard

The Memotech plug-in Keyboard plus buffer pack takes the effort out of data entry for ZX81 users. The Keyboard has a light professional touch and is housed in an elegant aluminium case. The simple plug-in system means that you are not obliged to open up your ZX81, use a soldering iron or invalidate your ZX81 warranty.

Keyboard Buffer Pak

The Buffer Pak performs a "housekeeping" function for the Keyboard, interfacing directly with the port of your ZX81.

£34.95 inc. VAT



All Prices are inclusive of VAT, postage and packing.

To Order: Send your Name, Address, Memopaks required, plus a Cheque/Postal Order/Access/Barclaycard number (please state which) to: Memotech Limited, Station Lane Industrial Estate, Witney, Oxon. OX8 6BX. Telephone Witney 2977

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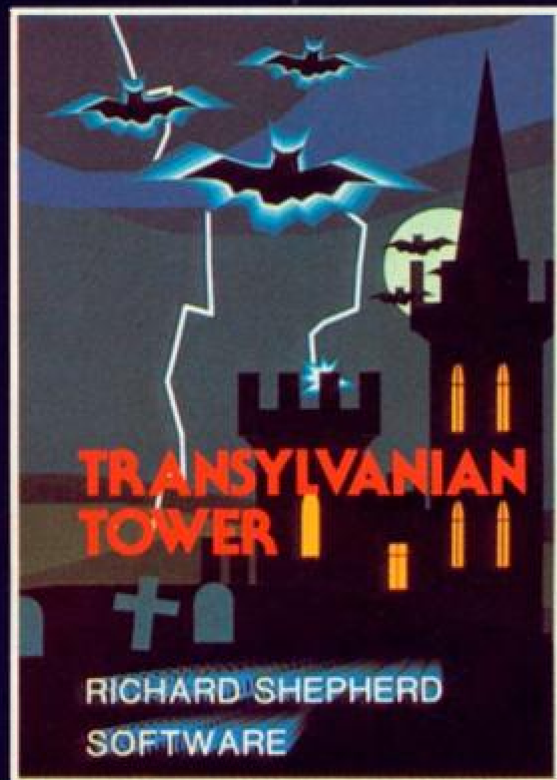
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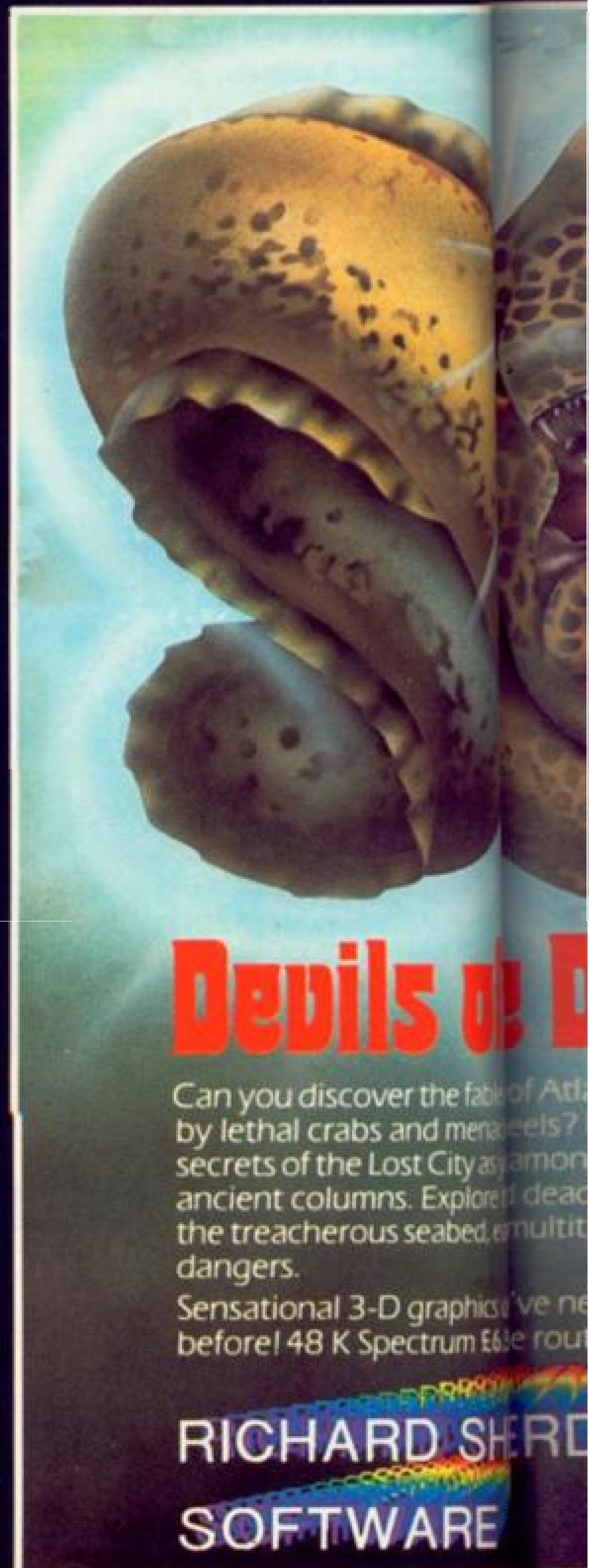
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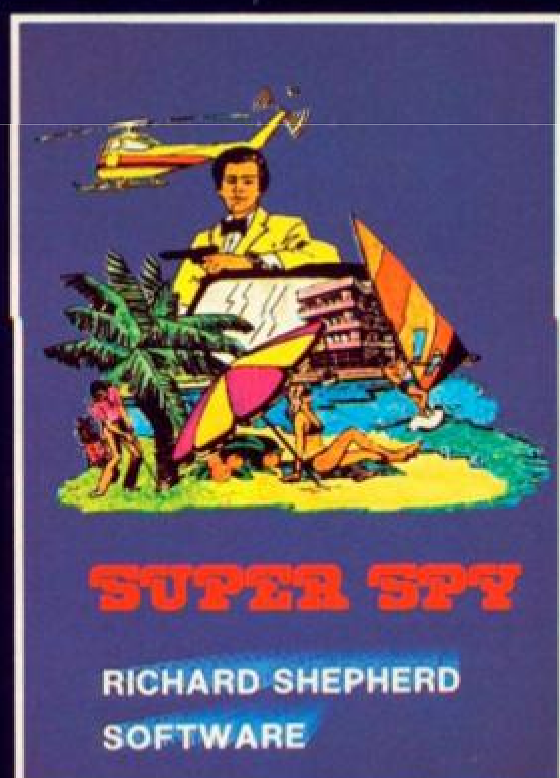




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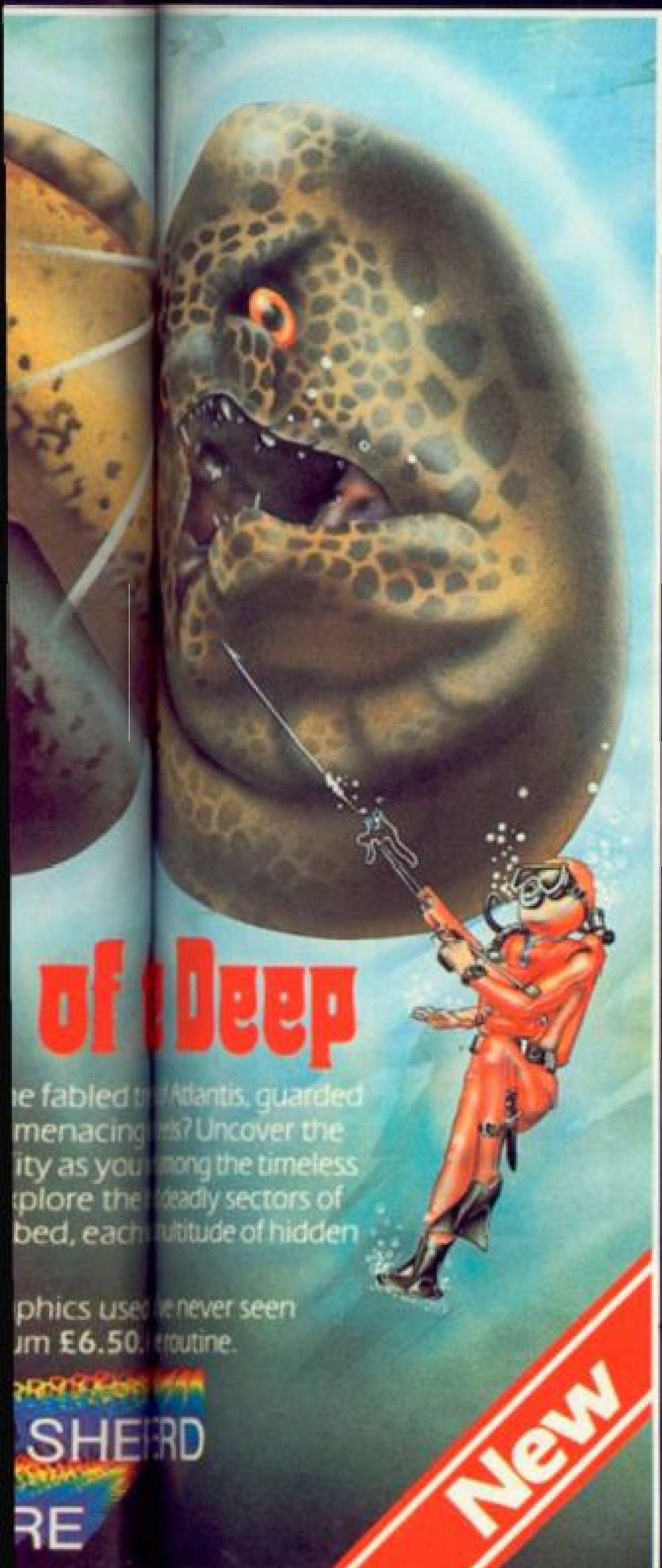
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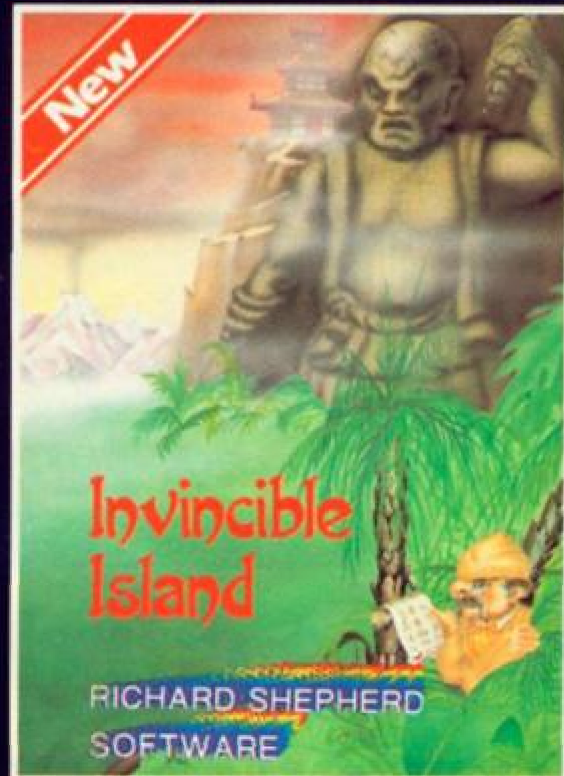
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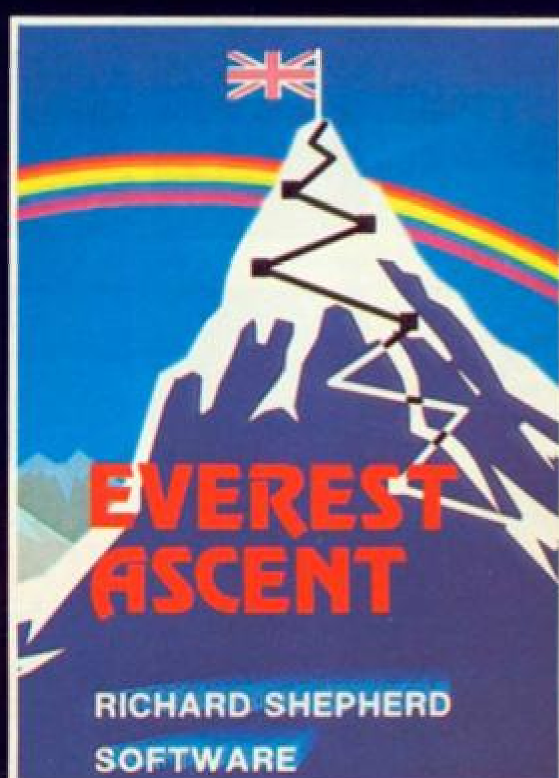




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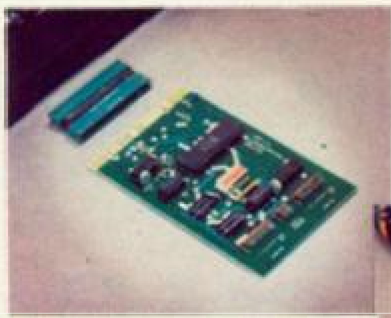
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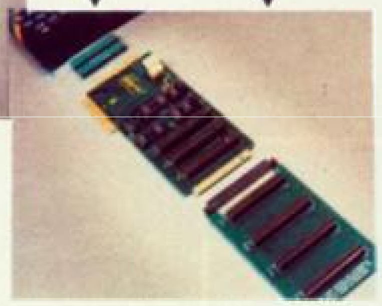
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The price/computer power ratio of the Spectrum is tremendous but up to now its lacked one major thing compared with other Z80, 48K computers costing many times more – expandability.

U-Microcomputers have been the UK leaders in Apple Expansion cards but with the Spectrum we've had to provide the means to expansion (3 and 4 *slot backplanes*) as well as the initial range:

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USP-ADAP



USP-BBP3



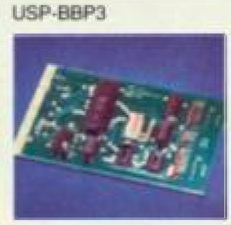
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USP-232D



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all the boards (except the USP-PROT) have gold plated edge connectors, and solder resist both sides for long term reliability. Comprehensive documentation for beginner or expert included with each board.

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Frustration

Don't 'lose your cool' in this program from Mike Whitcombe of Havant.

Frustration is a game for the 16K ZX81 – the reason for its name may become clear as you play the game!

The object of the game is to place a flashing pixel on the target pixel which sits in one of the corners of the screen and to do so in the least number of moves. The game is played four times in all with some added difficulty each time. The keys, 5 to 8, control the direction in which the pixel moves. Pressing 'C' will clear away the trail left by the moving dot and is useful if the screen becomes too confusing.

In the first game, the target dot stays in the top left-hand corner of the screen, but in subsequent games it moves randomly between the four corners of the screen. The third and fourth games are played against a half-blacked or completely blacked background.

Good luck and have fun!

```
  10 GOTO 2000
  20 LET A$=INKEY$
  30 IF A$="5" AND A<>-1 THEN LE
T A=A-1
  40 IF A$="7" AND B<>1 THEN LET
 B=B+1
  50 IF A$="6" AND B<>-1 THEN LE
T B=B-1
  60 IF A$="8" AND A<>1 THEN LET
 A=A+1
  70 RETURN
 100 IF RND<.98 THEN RETURN
 110 UNPLOT X1,Y1
 120 IF RND>.5 THEN GOTO 140
 130 LET X1=(NOT (X1=63))*63
 135 IF RND>.5 THEN GOTO 150
 140 LET Y1=(NOT (Y1=43))*43
 145 UNPLOT 0,43
 150 UNPLOT 63,43
 152 UNPLOT 0,0
 156 UNPLOT 63,0
 158 PLOT X1,Y1
 160 RETURN
 200 FAST
 210 CLS
 220 FOR I=1 TO 22
 230 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒▒▒"
 240 NEXT I
 250 UNPLOT 0,43
 260 UNPLOT 63,0
 265 PLOT X1,Y1
 270 SLOW
 280 RETURN
 300 PRINT AT 0,0;"MADE IT IN ";
C;" MOVES"
 310 IF G=4 THEN STOP
 320 FOR I=1 TO 100
 330 NEXT I
 340 LET G=G+1
 345 CLS
 350 IF G=2 THEN GOTO 2100
 360 IF G=3 THEN GOTO 2300
 370 IF G=4 THEN GOTO 2500
 400 IF X+A>63 OR X+A<0 THEN LET
 A=-A
 410 IF Y+B>43 OR Y+B<0 THEN LET
 B=-B
 420 LET X=X+A
 430 LET Y=Y+B
 435 UNPLOT X,Y
 440 PLOT X,Y
 450 RETURN
 500 FAST
 510 CLS
 515 PRINT "██████████████████████
██████████"
 520 FOR I=1 TO 20
 530 PRINT "██████████████████████
██████████"
 540 NEXT I
 550 PRINT "██████████████████████
██████████"
 560 PLOT X1,Y1
 570 SLOW
 580 RETURN
1000 LET C=0
1005 CLS
1010 LET A$=""
1020 LET X=20
1030 LET X1=0
1050 LET Y=20
1060 LET Y1=43
1070 LET A=0
1080 LET B=0
1085 PLOT X,Y
1087 PLOT X1,Y1
1090 RETURN
2000 REM BASIC GAME
2002 GOSUB 1000
2005 LET G=1
2010 LET C=C+1
2020 IF X=X1 AND Y=Y1 THEN GOTO
300
2030 GOSUB 20
2040 IF A$="C" THEN CLS
2050 IF A$="C" THEN PLOT X1,Y1
2060 LET A$=""
2070 GOSUB 400
2080 GOTO 2010
2100 REM MOVABLE CORNER
2110 GOSUB 1000
2120 LET C=C+1
2130 IF X=X1 AND Y=Y1 THEN GOTO
300
2140 GOSUB 100
2150 GOSUB 20
2160 IF A$="C" THEN CLS
2170 IF A$="C" THEN PLOT X1,Y1
2180 LET A$=""
2190 GOSUB 400
2200 GOTO 2120
2300 REM GRID
2310 GOSUB 1000
2320 GOSUB 200
2330 LET C=C+1
2340 IF X=X1 AND Y=Y1 THEN GOTO
300
2350 GOSUB 100
2360 GOSUB 20
2370 IF A$="C" THEN GOSUB 200
2380 LET A$=""
2390 GOSUB 400
2400 GOTO 2330
2500 REM BLACK SCREEN
2510 GOSUB 1000
2520 GOSUB 500
2530 LET C=C+1
2540 IF X=X1 AND Y=Y1 THEN GOTO
300
2550 GOSUB 100
2560 GOSUB 20
2570 IF A$="C" THEN GOSUB 500
2580 LET A$=""
2590 GOSUB 400
2600 GOTO 2530
5000 SAVE "FRUSTRATION"
5010 RUN
6000 REM BY M.J.WHITCOMBE 1983
```

Spectrum golfer

An incredible golf simulation program for your 48K Spectrum from Ian Turtle of Scunthorpe.



This program, taking up around 28K of memory, is a complete simulation of a round of an 18 hole golf course.

Once typed in and RUN, the program will ask you if you wish to play on a standard course or a random one. The standard course represents your home course and is the one where your handicap will be assessed. The random option allows you to play on any one of 65,535 courses. All you have to do is to indicate that you wish to play on one of the random courses and then input a number between one and 65535. You can always play one of the random courses again by typing in the same number — of course, if you get to the stage when you're playing a course again having played all the others, you'll probably be ready to get yourself a bag of golf clubs and try the real thing!

Fore!

When you play a game, you will be asked for your handicap — if it is your first game you should input '26'. If you manage to improve this score then your handicap will be adjusted to a lower figure at the end of the round.

As you go round the course, there is an on-screen representation of the various conditions of each hole. The fairway, greens, bunkers, trees, water, the pin and the tee are all shown as various graphic symbols which will be explained to you as a series of on-screen instructions at the beginning of play.

As you play around the course, you have the choice of using a one to four wood, one to nine irons or a putter, the latter obviously being used on the greens.

In a menu format you are provided with the option of clubs, the approximate distances you can expect the ball to travel and the chance to gauge the accuracy of how you hit the ball thus providing greater precision. You are then asked to input the angle of the shot based on a chart which will be displayed on-screen.

On the green

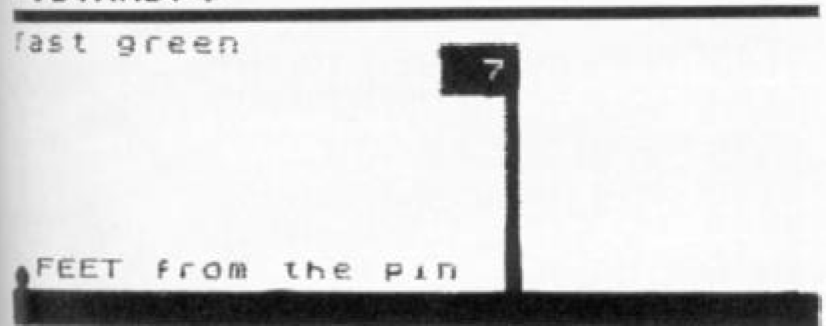
Once you manage to get your ball on the green, you have to input the strength of your putt, depending on the speed of the green which can either be slow, medium or fast. Full instructions for how to do this will be provided.

A few points to note are that the scale on the 'bird's eye' view of the hole is 20 yards for each square, and that when you are presented with the 'CHOOSE YOUR CLUB' prompt, you are given the legal choice of clubs. Also, you have the option of studying your scorecard after each hole has been completed — under par scores are shown in red and over par scores are shown in blue.

```
1 REM Graphical Golf-I.Turtle
2 REM
3 REM
4 REM  19.98K RAM + Screen
5 :
6 REM ************************
7 REM         Main loop
8 REM ************************
9 :
10 GO SUB 1000: REM Initialize
20 FOR h=1 TO 18
25 RANDOMIZE : LET sh=0: LET a
$="T": LET paper=3: LET ink=7
30 GO SUB 2000: REM Display
40 GO SUB 3000: REM The shot
45 PAUSE 75
50 GO SUB 4000: REM On green
60 GO SUB 5000: REM Keep score
70 NEXT h
80 GO SUB 6000: REM End disp.
90 IF playagain THEN GO TO 10
990 STOP
995 :
996 REM ************************
997 REM  Initialize subroutine
998 REM ************************
999 :
1000 GO SUB 1280: REM Init.Vars.
1005 GO SUB 9000: REM Instructs
1010 PRINT "Random or normal cou
rse?(r/n)"
1020 PAUSE 0: LET a$=INKEY$
1030 IF a$<>"n" AND a$<>"r" THEN
 GO TO 1020
1039 REM Par,length,score
1040 DIM p(18): DIM l(18): DIM s
(18)
1050 IF a$="r" THEN GO TO 1110
1060 RESTORE 9990
1070 FOR h=1 TO 18
1080 READ l(h): READ p(h)
1090 NEXT h
1100 GO TO 1250: REM Handicap
1109 REM Random
1110 PRINT "Course no? ENTER if
not bothered"
1120 INPUT LINE d$
1130 IF d$="" THEN RANDOMIZE : G
O TO 1150
1135 GO SUB 6500: IF NOT legal T
HEN BEEP .4,20: BEEP .4,20: GO T
O 1120
1140 RANDOMIZE (VAL d$)
1150 LET par=0
1160 FOR h=1 TO 18
1170 LET l(h)=INT (RND*411)+140
1180 LET p(h)=3+(l(h)>240)+(l(h)
>449)
1185 IF p(h)<>4 AND RND<.6 THEN
GO TO 1170
1190 LET par=par+p(h)
1200 NEXT h: PRINT "Par=";par
1210 PRINT "O.K?"
1220 PAUSE 0: LET a$=INKEY$
1230 IF a$<>"y" AND a$<>"n" THEN
 GO TO 1220
1240 IF a$="n" THEN GO TO 1110
1249 REM Get handicap
1250 PRINT '"Input your handicap
(0-28)"
1260 INPUT LINE d$: GO SUB 6500:
 IF legal THEN GO TO 1270
1265 BEEP .4,20: BEEP .4,20: GO
TO 1260
1270 LET ha=VAL d$: IF ha<0 OR h
a>28 THEN GO TO 1265
1275 RETURN
1279 REM Rest of var. dec.
1280 RESTORE 9900
1285 FOR i=1 TO 7: READ a$
1290 FOR j=0 TO 7: READ any
1300 POKE USR a$+j,any
1310 NEXT j: NEXT i
1319 REM Rough,spaces
1320 LET r$="": LET c$=""
1330 FOR i=1 TO 32
1340 LET r$=r$+"A": LET c$=c$+CH
R$ 32
1350 NEXT i
1359 REM Values for attributes
1360 LET rough=38: LET water=47
1370 LET fairway=6: LET pin=56
1380 LET green=4: LET bunker=39
1390 LET tree=32
1400 LET rc=1: LET mc=0
1410 LET ts=0: LET pr=0
1990 RETURN
1995 :
1996 REM ************************
1997 REM       Draw display
1998 REM ************************
1999 :
2000 GO SUB 2100: REM Rough
2010 GO SUB 2200: REM Fairway+
2020 GO SUB 2300: REM Water
2030 GO SUB 2400: REM Green+pin
2033 GO SUB 2500: REM Trees
2035 GO SUB 2700: REM Bunkers
2040 GO SUB 2900: REM Tee
2045 RETURN
2049 REM Clear bottom two lines
2050 PAPER 7
2060 PRINT AT 20,0;c$
2070 PRINT AT 21,0;c$
2090 RETURN
2099 REM Rough
2100 PAPER 4: INK 6: CLS
2110 FOR i=1 TO 19
2120 PRINT r$
2130 NEXT i
2140 PRINT TAB 4; PAPER 7; INK 1
;"Hole ";h;",Length ";l(h);",Par
";p(h)
2150 GO SUB 2050
2190 RETURN
2199 REM Draw fairway
2200 PAPER 0: INK 6: LET vp=3+IN
T (RND*13)
2210 LET vp1=vp: LET hp=INT (l(h
)/20)
2220 FOR a=1 TO hp
2230 FOR b=-1-(RND>.5) TO 1+(RND
>.5)
2240 PRINT AT vp+b,a-1;"█"
2250 NEXT b
2260 LET vp=vp+(RND>.5)-(RND>.5)
2270 LET vp=vp-(vp>16)+(vp<2)
2280 NEXT a
2290 LET vp2=vp
2295 RETURN
2299 REM Water
2300 IF RND>.25 THEN RETURN
2310 PAPER 5: INK 7
2320 LET hp=INT (l(h)/40)
2330 FOR a=0 TO 18
2340 PRINT AT a,hp;"D"
2350 LET hp=hp+(RND>.5)-(RND>.5)
2360 LET hp=hp-(hp>=INT (l(h)/20
-2))+(hp<2)
2370 NEXT a
2390 RETURN
2399 REM Green+pin
2400 PAPER 0: INK 4: LET vp=vp2
2410 LET hp=INT (l(h)/20)-1
2420 FOR a=-1-(RND>.5) TO 1+INT
(RND>.5)
2430 FOR b=-1-(RND>.5) TO 1+INT
(RND>.5)
2440 PRINT AT vp+b,hp+a;"█"
2450 NEXT b: NEXT a
2459 REM Pin
2460 PRINT PAPER 7; INK 0;AT vp,
hp;"C"
2470 LET hpf=hp
2480 LET vpf=vp
2490 RETURN
2499 REM Trees
2500 IF RND>.9 THEN RETURN
2510 RESTORE 9970: FOR k=1 TO 3+
```

```
(RND>.7)+(RND>.7): READ vp: READ
 not: LET i=0
2520 IF ATTR (i,vp)=fairway OR A
TTR (i,vp)=green THEN GO TO 2540
: REM Place trees
2530 LET i=i+1: IF i=19 THEN GO
TO 2590: REM No trees
2535 GO TO 2520
2540 LET i=i+2
2550 FOR j=1 TO not: LET tre=RND
2560 LET i1=i-INT ((4+RND*3)*(tr
e>.5))+INT ((4+RND*3)*(tre<=.5))
2570 IF ATTR (i1,vp)=rough THEN
PRINT AT i1,vp; PAPER 4; INK 0;"
E"
2580 NEXT j
2590 NEXT k: RETURN
2699 REM Bunkers
2700 PAPER 4: INK 7: LET vp=vpf
2705 LET zz=-4+INT (RND*9): LET
yy=ATTR (vp+zz,hp)
2710 IF yy<>rough AND yy<>fairwa
y THEN GO TO 2705
2720 PRINT AT vp+zz,hp;"B"
2730 FOR a=1 TO 2+(RND>.4)
2740 LET zz=-3-INT (RND*3): LET
xx=-3+INT (RND*7)
2750 LET yy=ATTR (vp+xx,hp+zz)
2760 IF yy<>rough AND yy<>fairwa
y THEN GO TO 2740
2770 PRINT AT vp+xx,hp+zz;"B": N
EXT a
2780 IF p(h)<4 THEN RETURN
2790 LET hp=10: GO SUB 2830
2800 IF p(h)<5 THEN RETURN
2810 LET hp=17: GO SUB 2830
2820 RETURN
2830 FOR a=1 TO 2+(RND>.4)
2840 LET zz=hp+INT (RND*4): FOR
b=0 TO 18
2850 IF ATTR (b,zz)<>fairway THE
N GO TO 2870
2860 PRINT AT b,zz;"B": GO TO 28
80
2870 NEXT b
2880 NEXT a
2890 RETURN
2899 REM Tee
2900 LET vp=vp1: LET hp=0
2910 PAPER 3: INK 7
2920 PRINT AT vp,hp;"T"
2990 RETURN
2995:
2996 REM ***********************
2997 REM    Play onto the green
2998 REM ***********************
2999:
3000 GO SUB 3100: REM Club,angle
3010 LET ps=1: IF ci<21 THEN GO
TO 3030
3020 GO SUB 3200: REM % swing
3030 IF sh>=1 THEN GO SUB 3900:
REM Remove old divot
3035 GO SUB 3250: REM Calc.displ
3040 LET sh=sh+1: PRINT PAPER 7;
 INK 0;AT 0,0;CHR$ (48+sh)
3050 LET rc=1: LET mc=0
3060 GO TO 3300: REM Land.pos+
3070 RETURN
3099 REM Get club and angle
3100 PAPER 7: INK 1
3110 PRINT AT 21,0;"Input club("
;
3112 IF mc=0 THEN PRINT "1-4,11-
19,21-29)"
3114 IF mc=11 THEN PRINT "11-19,
21-29)"
3116 IF mc=29 THEN PRINT "29)"
3118 IF mc>20 AND mc<>29 THEN PR
INT mc;"-29)"
3120 INPUT LINE d$: GO SUB 6500:
 IF legal THEN GO TO 3130:
3125 BEEP .4,20: BEEP .4,20: GO
TO 3120
3130 LET ci=VAL d$: IF (ci<1 OR
ci>29) OR (ci>4 AND ci<11) OR ci
=20 OR ci<mc OR ci<>INT ci THEN
GO TO 3125
3140 PRINT AT 21,0;"Angle of Sho
t(-180 TO 180)"
3150 INPUT LINE d$: IF d$<>"" TH
EN IF d$(1)="j" OR d$(1)="J" THE
N LET d$(1)="-"
3155 GO SUB 6500: IF legal THEN
GO TO 3160
3157 BEEP .4,20: BEEP .4,20: GO
TO 3150
3160 LET as=VAL d$: IF as<-180 O
R as>180 THEN GO TO 3157
3170 LET as=as+INT (RND*(22+ha))
-INT (RND*(22+ha))
3180 LET as=as*PI/180
3190 RETURN
3199 REM Get % swing
3200 PRINT AT 21,0;"Input percen
tage swing(10-100)"
3210 INPUT LINE d$: GO SUB 6500:
 IF legal THEN GO TO 3220
3215 BEEP .4,20: BEEP .4,20: GO
TO 3210
3220 LET ps=VAL d$: IF ps<10 OR
ps>100 THEN GO TO 3215
3230 LET ps=ps/100
3240 RETURN
3249 REM Calculate displacement
3250 IF ci>20 THEN LET ci=ci-10
3260 IF ci>10 THEN LET ci=ci-6
3270 LET ci=16-ci
3280 LET hs=INT ((ci*(12+INT (RN
D*3))+38)*ps*COS (as)*rc/20+.5)
3290 LET vs=INT ((ci*(12+INT (RN
D*3))+38)*ps*SIN (as)*rc/20+.5)
3295 RETURN
3299 REM Landing pos onwards
3300 GO SUB 2050: PAPER 7: INK 2
3305 IF hp+hs>31 OR hp+hs<0 OR v
p+vs>18 OR vp+vs<0 THEN GO TO 33
60: REM O.O.B.
3310 LET hp=hp+hs: LET vp=vp+vs
3320 LET yy=ATTR (vp,hp)
3330 IF yy<>water THEN GO TO 338
0
3339 REM In water
3340 PRINT AT 20,0; FLASH 1;"SPL
ASH-In water,penelty 1 stroke"
3350 LET b$=a$: LET paper1=paper
: LET ink1=ink: LET a$="D": LET
paper=5: LET ink=7: GO SUB 3800:
 GO SUB 3900
3355 LET sh=sh+1: LET hp=hp-hs:
LET vp=vp-vs: LET a$=b$: LET pap
er=paper1: LET ink=ink1: GO SUB
3800: GO TO 3000
3359 REM Out of bounds
3360 PRINT AT 20,0; FLASH 1;"OUT
 OF BOUNDS, Penelty 1 stroke "
3370 LET sh=sh+1: GO SUB 3800: G
O TO 3000
3380 IF yy<>green THEN GO TO 341
0
3389 REM On green
3390 PRINT AT 20,0;"On the green
 in ";sh;" shot(s)"
3400 LET a$="█": LET paper=0: LE
T ink=4: GO SUB 3800: RETURN
3410 IF yy<>rough THEN GO TO 347
0
3419 REM In rough
3420 LET rgh=RND
3430 LET mc=11: PRINT AT 20,0;"Y
ou're in ";
3440 IF rgh>.5 THEN PRINT "heav
 rough": LET rc=.5+RND/4
3450 IF rgh<=.5 THEN PRINT "lig
█ rough": LET rc=.75+RND/4
3460 LET a$="A": LET paper=4: LE
T ink=6: GO SUB 3800: GO TO 300
3470 IF yy<>bunker THEN GO TO 35
```

```
60
3479 REM Bunkered
3480 PRINT AT 20,0;"Bunkered-Lie
 is ";
3490 LET bker=INT (RND*3)
3500 IF bker=0 THEN LET mc=24+(R
ND>.5): PRINT "GOOD";
3510 IF bker=1 THEN LET mc=26+(R
ND>.5): PRINT "O.K.";
3520 IF bker=2 THEN LET mc=28+(R
ND>.5): PRINT "BAD";
3530 PRINT "-Max club ";mc
3540 LET rc=.7-bker*.1+RND/5
3550 LET a$="B": LET paper=4: LE
T ink=7: GO SUB 3800: GO TO 3000
3560 IF yy<>tree THEN GO TO 3640
3569 REM In trees
3570 PRINT AT 20,0;"In trees-";
3580 LET trs=INT (RND*3): LET rc
=.5+RND/4
```



If you thought reaching the green was difficult, just wait until you try to putt out!

```
3590 IF trs=0 THEN PRINT "v.bad"
;
3600 IF trs=1 THEN PRINT "bad";
3610 IF trs=2 THEN PRINT "lucky"
;
3620 LET mc=29-trs-(RND>.8): PRI
NT " lie,max club ";mc
3630 LET a$="E": LET paper=4: LE
T ink=0: GO SUB 3800: GO TO 3000
3639 REM On fairway
3640 IF yy<>fairway THEN GO TO 3
670
3650 PRINT AT 20,0;"You are on t
he fairway"
3660 LET a$="█": LET paper=0: LE
T ink=6: GO SUB 3800: GO TO 3000
3669 REM On flag
3670 PRINT AT 20,0;"On the green
 in ";sh;"-and close."
3680 LET a$="C": LET paper=7: LE
T ink=0: GO SUB 3800: RETURN
3799 REM Flash ball off and on
3800 FOR i=1 TO 6
3810 PAPER paper: INK ink
3820 PRINT AT vp,hp;a$: PAUSE 15
3830 PAPER 7: INK 2
3840 PRINT AT vp,hp;"F": PAUSE 1
5
3850 NEXT i
3860 RETURN
3899 REM Replace old divot
3900 PAPER paper: INK ink
3910 PRINT AT vp,hp;a$
3920 RETURN
3995:
3996 REM ************************
3997 REM         Putting
3998 REM ************************
3999:
4000 GO SUB 4100: REM Display
4010 LET dp=INT (SQR ((hpf-hp)*(
hpf-hp)+(vpf-vp)*(vpf-vp))*15+1+
RND*15)
4020 LET hbp=19: GO SUB 4500
4030 IF ABS dp<=1 THEN GO TO 430
0: REM Inhole
4040 PRINT AT 9,19-hbp; PAPER 5;
 INK 7;"G"
4050 GO SUB 4350: REM Puttinput
4060 GO SUB 4400: REM New dist
4070 GO SUB 4500: REM Ball roll
4080 GO TO 4030
4099 REM Draw putting display
4100 PAPER 5: CLS
4110 PAPER 7: FOR i=12 TO 21: PR
INT AT i,0;c$: NEXT i: PAPER 5
4120 IF h<=9 THEN LET ink=1
4130 IF h>=10 THEN LET ink=2
4140 PRINT AT 0,17; PAPER 5; INK
 ink;"█"
4150 PRINT TAB 17; PAPER 5; INK
ink;"███"
4160 PRINT TAB 17; PAPER 5; INK
ink;"█"
4170 INK ink: LET msig=INT (h/10
)
4180 LET lsig=h-msig*10
4190 IF msig<>0 THEN PRINT AT 1,
18; PAPER 7; INVERSE 1; BRIGHT 1
;msig
4200 PRINT AT 1,19; PAPER 7; INV
ERSE 1; BRIGHT 1;lsig
4210 INK 0: PAPER 5
4220 FOR i=0 TO 6: PRINT AT 3+i,
20;"█": NEXT i
4230 FOR i=1 TO 2: PRINT INK 4;"
███████████████████"; INK 0;"██"
; INK 4;"██████████"
4240 NEXT i
4250 PAPER 7: INK 0: PRINT : PRI
NT "    FEET from the pin"
4260 LET tg=2+INT (RND*3)
4270 PAPER 5: INK 0: PRINT AT 0,
0;
4280 IF tg=2 THEN PRINT "slow";
4285 IF tg=3 THEN PRINT "medium"
;
4290 IF tg=4 THEN PRINT "fast";
4295 PRINT " green": RETURN
4299 REM In the hole,ball drops
4300 PRINT AT 9,19; PAPER 5;" ":
 PRINT AT 10,19; PAPER 0; INK 7;
"G": PAUSE 10
4310 PRINT AT 10,19; PAPER 0;" "
4320 PRINT AT 11,19; PAPER 0; IN
K 7;"G": PAUSE 100
4330 RETURN
4349 REM Get putt strength
4350 PAPER 7: INK 0: PRINT AT 13
,0;ABS dp
4360 PRINT AT 15,0;"Input your p
utt strength(1-30)"
4365 INPUT LINE d$: GO SUB 6500:
 IF legal THEN GO TO 4370
4367 BEEP .4,20: BEEP .4,20: GO
TO 4365
4370 LET ps=VAL d$: IF ps<1 OR p
s>30 THEN GO TO 4367
4380 PRINT AT 15,0;c$: PRINT AT
13,0;"    "
4390 LET sh=sh+1: RETURN
4399 REM Get new pos from pin
4400 IF dp<0 THEN LET dir=1
4410 IF dp>0 THEN LET dir=-1
4420 FOR i=1 TO ps: LET dp=dp+di
r*(1+INT (RND*tg)): NEXT i
4430 RETURN
4499 REM Rolling of the ball
4500 LET nhbp=INT ((dp+1)/3)
4505 LET nhbp=nhbp-(nhbp=-1)
4510 IF nhbp<-12 THEN LET nhbp=-
12
4520 IF nhbp>19 THEN LET nhbp=19
4530 IF nhbp>=hbp THEN LET step=
1
4540 IF nhbp<hbp THEN LET step=-
1
4545 LET pause=10+5*(tg=4)-5*(tg
=2)-ABS (nhbp-hbp): IF pause-1<A
BS hbp-30 THEN LET pause=ABS hbp
-29
4550 FOR i=hbp TO nhbp STEP step
4560 PRINT AT 9,19-i; PAPER 5; I
NK 7;"G"
```

```
4570 PAUSE pause+30-ABS i
4580 IF i=-1 THEN PRINT AT 9,20;
 PAPER 5; INK 0;"█"
4590 IF i<>-1 THEN PRINT AT 9,19
-i; PAPER 5;" "
4600 NEXT i
4610 LET hbp=nhbp
4620 RETURN
4995:
4996 REM ********************
4997 REM      Keep score
4998 REM ********************
4999:
5000 GO SUB 5100: REM Keep score
5010 GO SUB 5200: REM Comment
5020 GO SUB 5400: REM Scorecard
5090 RETURN
5099 REM Store card
5100 LET s(h)=sh
5110 LET ts=ts+sh
5120 LET pr=pr+p(h)
5190 RETURN
5199 REM Comment on score
5200 PAPER 7: INK 3: CLS
5210 PRINT "You holed out in ";s
h;" shots."
5220 LET zz=sh-p(h)
5230 PRINT
5240 IF zz=-3 AND p(h)<>4 THEN P
RINT "Excellent,an albatross."
5250 IF (zz=-3 AND p(h)=4) OR (z
z=-2 AND p(h)=3) THEN PRINT "Unb
elievable,a hole in one."
5260 IF zz=-2 AND p(h)<>3 THEN P
RINT "Great,an eagle."
5270 IF zz=-1 THEN PRINT "Very g
ood,a birdie."
5280 IF zz=0 THEN PRINT "Well do
ne,a par."
5290 IF zz=1 THEN PRINT "Hhmmm,a
 bogey."
5300 IF zz=2 THEN PRINT "Oooops,
a double bogey."
5310 IF zz>2 THEN PRINT "Keep yo
ur head down."
5320 PRINT : PRINT
5330 LET zz=ts-pr
5340 PRINT "You are now ";
5350 IF zz<0 THEN PRINT ABS zz;"
 under";
5360 IF zz=0 THEN PRINT "level";
5370 IF zz>0 THEN PRINT zz;" ove
r";
5380 PRINT " par(gross)."
5390 PRINT : RETURN
5399 REM Scorecard
5400 PRINT "Do you want to see a
 scorecard?"
5410 PAUSE 0: LET a$=INKEY$
5420 IF a$<>"y" AND a$<>"n" THEN
 GO TO 5410
5430 CLS : IF a$="n" THEN RETURN

5499 REM Print out scorecard
5500 PRINT TAB 12; PAPER 5; INK
1; BRIGHT 1;"SCORECARD"
5510 PRINT PAPER 7; INK 2;TAB 3;
"HOLE";TAB 11;"DIST";TAB 19;"PAR
";TAB 26;"SHOTS"
5520 FOR i=1 TO 18
5530 PRINT PAPER 7; INK 4;TAB 4;
i;TAB 12;l(i);TAB 20;p(i);
5540 IF s(i)=0 THEN GO TO 5580
5550 IF s(i)-p(i)<0 THEN PRINT T
AB 28; PAPER 2; INK 7;s(i)
5560 IF s(i)-p(i)=0 THEN PRINT T
AB 28; PAPER 7; INK 0;s(i)
5570 IF s(i)-p(i)>0 THEN PRINT T
AB 28; PAPER 1; INK 7;s(i)
5580 NEXT i
5590 PRINT TAB 19; PAPER 7; INK
3;pr;TAB 27;ts
5600 PRINT PAPER 5; INK 1; FLASH
 1;"Any key to continue"
5610 PAUSE 0: CLS : RETURN
```

```
5995:
5996 REM ********************
5997 REM    End of the round
5998 REM ********************
5999:
6000 GO SUB 6100: REM Final sco
e
6010 IF ha>0 THEN GO SUB 6200: R
EM Handicap
6020 GO SUB 6300: REM Play agai
6090 RETURN
6099 REM Final score+comment
6100 GO SUB 5500: PAPER 7: INK
6110 PRINT "You took ";ts;" sho
s,"
6120 PRINT "(Net ";ts-ha;" shot
.)"
6130 LET zz=ts-pr-ha
6140 PRINT
6150 PRINT "That was ";
6160 IF zz<0 THEN PRINT ABS zz;
 under";
6170 IF zz=0 THEN PRINT "level"
6180 IF zz>0 THEN PRINT zz;" ov
r";
6190 PRINT " par(net).": PRINT
 RETURN
6199 REM Handicap change
6200 IF zz<0 THEN LET pd=INT (A
S (zz/2)+.5)*(zz<0): IF pd>ha T
EN LET pd=ha
6205 IF zz>=0 THEN LET pd=0
6210 PRINT "As a result:"
6220 PRINT "Your handicap ";
6230 IF pd=0 THEN PRINT "remain
 at ";ha
6240 IF pd>0 THEN PRINT "is dow
";pd;" shot(s)","(to ";ha-pd;"
shot(s).)"
6250 PRINT
6260 RETURN
6299 REM Another game?
6300 PRINT "Do you want another
round?"
6310 PAUSE 0: LET a$=INKEY$
6320 IF a$<>"y" AND a$<>"n" THE
 GO TO 6310
6330 IF a$="y" THEN LET playaga
n=1
6340 IF a$="n" THEN LET playaga
n=0
6350 RETURN
6499 REM  String legality check
6500 LET legal=1: IF d$="" THEN
LET legal=0: RETURN
6505 FOR i=1 TO LEN d$
6510 IF NOT (d$(i)>="0" AND d$(
)<="9" OR d$(i)="." OR d$(i)="-
) THEN LET legal=0
6520 NEXT i: RETURN
8995:
8996 REM ********************
8997 REM  Instruction subroutin
8998 REM ********************
8999:
9000 LET dp=0: LET h=7: GO SUB
100: LET hbp=19: GO SUB 4500: G
SUB 4300: REM Init.display
9005 PAPER 2: INK 7: PRINT AT 3
0;c$
9010 PRINT "Graphical Golf-Ian
untle"
9015 PRINT c$: PRINT
9020 PRINT "  Do you want the i
structions? "
9030 PAUSE 0: LET a$=INKEY$
9040 IF a$<>"y" AND a$<>"n" THE
 GO TO 9030
9045 IF a$="n" THEN CLS : RETUR

9050 PAPER 7: INK 0: CLS : PRIN
 " The program is a full eighte
n hole simulation of a round of
 golf.At the start of the prog
am you will be asked whether you
```

```
want to play the standard cou
seor a random one."
9060 PRINT '" The standard cours
e can be        considered to be yo
ur 'home'       course,i.e. the one
 that your      handicap is based o
n."
9070 PRINT '" The random option
gives you thechoice of 65535 dif
ferent          courses chosen by i
nputting a      whole number betwee
n 1 and         65535.(You can alwa
ys replay       this course by typi
ng in the       same number at the
start of the round.)"
9080 GO SUB 9895
9090 PRINT " The random course m
ay not have a par of 72."'" The
n you will be asked to inputyou
 handicap.Beginners start at28.I
f you play well then the     comp
uter will reduce your        hand
icap at the end of the round"
9100 GO SUB 9895
9110 PRINT " Play onto the green
."''"The computer will give you
a   'birds-eye' view of the hol
e.Thevarious symbols represent:"
9120 PRINT 'TAB 10; PAPER 4; INK
 6;"A";: PRINT " - rough"
9130 PRINT 'TAB 10; PAPER 6;" ";
: PRINT " - fairway"
9140 PRINT 'TAB 10; PAPER 4;" ";
: PRINT " - green"
9150 PRINT 'TAB 10; PAPER 4; INK
 7;"B";: PRINT " - bunker"
9155 PRINT 'TAB 10; PAPER 4; INK
 0;"E";: PRINT " - A tree"
9160 PRINT 'TAB 10; PAPER 5; INK
 7;"D";: PRINT " - water"
9170 PRINT 'TAB 10; PAPER 7; INK
 0;"C";: PRINT " - The pin"
9180 PRINT 'TAB 10; PAPER 3; INK
 7;"T";: PRINT " - The tee"
9190 GO SUB 9895
9200 PRINT " Play consists of se
lecting a     club,an angle and,op
tionally,a   percentage swing."''
" The following are your clubs
 and approximate yardages:"
9210 PRINT '"CLUB              NAME
    YARDAGE"
9220 PRINT "Driver            1
    233"
9230 PRINT "2-wood            2
    220"
9240 PRINT "3-wood            3
    207"
9250 PRINT "4-wood            4
    194"
9260 PRINT "1-iron          11/21
    181"
9270 PRINT "2-iron          12/22
    168"
9280 PRINT "3-iron          13/23
    155"
9290 PRINT "4-iron          14/24
    142"
9300 PRINT "5-iron          15/25
    129"
9310 PRINT "6-iron          16/26
    116"
9320 PRINT "7-iron          17/27
    103"
9330 PRINT "8-iron          18/28
    90"
9340 PRINT "9-iron          19/29
    77"
9350 GO SUB 9895
9360 PRINT " There are two choic
es of name     for the irons as the
 second        option allows you to
input a      percentage swing for
greater      accuracy."
9370 PRINT '" You are then asked
 to input an angle of shot,based
 on the       following chart": P
RINT
9380 PRINT TAB 12;"-90": PRINT T
AB 8;"-135 | -45    - for up"
9390 PRINT TAB 12;"\|/": PRINT T
AB 8;"180--G-- 0"
9400 PRINT TAB 12;"/|\": PRINT T
AB 9;"135 | 45     + for down"
9410 PRINT TAB 13;"90"
9420 PRINT '"(Any intermediate a
ngle is      allowed,e.g, -22.5.
)": GO SUB 9895
9430 PRINT "Play on the green."
9440 PRINT '" Putting consists o
f typing in  a putt strength dep
ending on thespeed of the green
and the       distance from the f
lag.As a      guide,for every one
 you input inreply the ball will
 travel the   following distances
(approx.)"
9450 PRINT 'TAB 5;"SLOW green...
. 1.5 ft"
9460 PRINT TAB 5;"MEDIUM green..
 2 ft"
9470 PRINT TAB 5;"FAST green....
 2.5 ft"
9480 PRINT '"e.g. a ten ft. putt
 on a medium green would require
 a strength   of 5."
9490 PRINT "e.g. a twenty ft. pu
tt on a fastgreen would require
a strength    of 8."
9500 GO SUB 9895
9510 PRINT " A few final details
:"
9520 PRINT '"1)The scale on the
'birds-eye     view of the hole
is 20 yards    to one square."
9530 PRINT "2)You have the optio
n of looking   at your scorecard
after every    hole.On the card,u
nder par       scores are shown i
n red and      over pars in blue.
"
9540 PRINT "3)Your legal choice
of clubs is    shown after the 'C
HOOSE YOUR     CLUB' prompt."
9550 PRINT AT 21,0;"Press any ke
y to begin."
9560 PAUSE 0: CLS : RETURN
9895 PRINT AT 21,0;"Press any ke
y to continue": PAUSE 0: CLS :
RETURN
9898 REM Data for u.d.graphics
9899 REM Rough
9900 DATA "a",255,0,255,0,255,0,
255,0
9909 REM Bunker
9910 DATA "b",56,124,254,127,63,
63,126,56
9919 REM Flag
9920 DATA "c",8,24,56,8,8,8,8,28
9929 REM Water
9930 DATA "d",16,32,16,8,4,2,4,8
9939 REM Trees
9940 DATA "e",8,28,28,62,127,127
,8,8
9949 REM Fairway ball
9950 DATA "f",0,0,0,24,24,0,0,0
9959 REM Green ball
9960 DATA "g",0,0,60,126,126,126
,126,60
9969 REM Data for tree placement
9970 DATA 10,4,11,8,12,12,13,8,1
4,4
9989 REM Lengths of holes,etc
9990 DATA 361,4,389,4,206,3,500,
5,408,4,359,4,424,4,388,4,196,3,
400,4,560,5,132,3,357,4,294,4,47
5,5,375,4,180,3,550,5
```

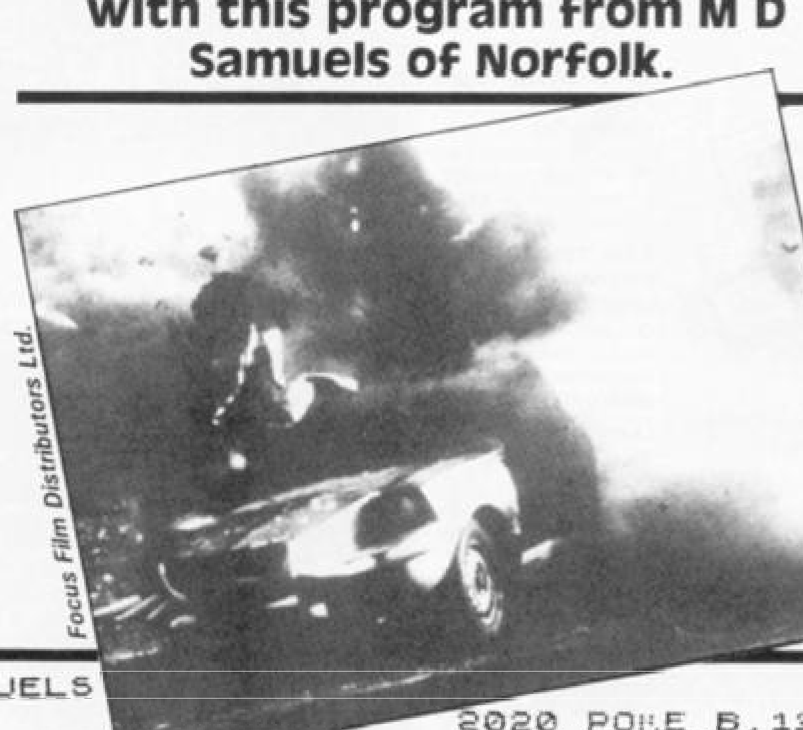
Death race

Drive your ZX81 to the limit with this program from M D Samuels of Norfolk.

The object of this game is to try and manoeuvre your car (represented by an asterisk) across the screen as many times as possible. The trouble is that your opponents have set up a scheme to try and stop you in your quest by setting up a series of road blocks.

Trouble is that your opponents haven't had much time to set up the roadblocks so some of them are not as good as others. The ineffective roadblocks are represented by grey blocks (made up from the graphics character on the 'H' key) and you get points for smashing through these. But you must take care of the black roadblocks.

To move around the screen, you use the '1' key to move the asterisk up and the 'A' key to move the asterisk down. Points are scored each time you cross the screen. Every fourth time you manage to cross the screen you will be awarded an extra life, but watch out for the black roadblocks as you will lose a life each time you hit one!



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Too easy?

To alter the difficulty of the game, try changing the '.5' in lines 210 and 220. Also, if you want to give yourself more (or less) lives, alter the '5' in line 90. The '4' in line 1030 controls the number of times you have to cross the screen to gain an extra life.

Should you find the game too slow, then try duplicating lines 260, 270 and 280 as lines 8000, 8010 and 8020. Then add the following lines:

260 IF PEEK B< >0 THEN GOTO 8000
8030 GOTO 290

and remove lines 270 and 280.

To SAVE the program, press the Break key, start the tape recorder and type RUN 7000 and press Newline.

```
   1 REM M.D.SAMUELS
  10 LET H$=""
  20 LET HS=0
  90 LET L1=5
 100 LET S=0
 110 LET A=PEEK 16396+256*PEEK 1
6397
 115 LET B=A+332
 120 LET C=23
 130 GOSUB 4000
 140 CLS
 150 PRINT "SCORE=        HISCORE="
;HS;"  LIVES="
 160 PRINT "████████████████████████
████████"
 170 FOR F=2 TO 20
 180 PRINT "█
         ▒"
 190 NEXT F
 200 PRINT "████████████████████████
████████"
 205 LET PASS=0
 210 IF RND>.5 THEN PRINT AT INT
 (RND*19)+2,INT (RND*23)+4;"▒"
 220 IF RND>.5 THEN PRINT AT INT
 (RND*19)+2,INT (RND*23)+4;"█"
 230 POKE B,0
 235 LET B=B+1
 240 IF INKEY$="1" THEN LET B=B-
33
 250 IF INKEY$="A" THEN LET B=B+
33
 260 IF PEEK B=128 THEN GOTO 200
0
 270 IF PEEK B=136 THEN LET S=S+
1
 280 IF PEEK B=151 THEN GOTO 100
0
 290 POKE B,C
 300 GOTO 210
1000 LET PASS=PASS+1
1010 LET B=A+(INT (RND*19)+2)*33
+2
1020 LET S=S+10
1030 IF PASS<4 THEN GOTO 1060
1040 LET PASS=0
1050 LET L1=L1+1
1060 PRINT AT 0,7;S;AT 0,29;L1
1070 GOTO 230
2000 LET PASS=0
2010 FOR F=1 TO 10
2020 POKE B,128
2030 FOR G=1 TO 4
2040 NEXT G
2050 POKE B,151
2060 FOR G=1 TO 4
2070 NEXT G
2080 NEXT F
2090 POKE B,128
2100 LET L1=L1-1
2110 IF L1=0 THEN GOTO 3000
2120 LET B=A+(INT (RND*19)+2)*33
+2
2130 GOTO 1060
3000 FOR F=1 TO 21
3010 PRINT AT F,0;"
                   "
3020 NEXT F
3025 PRINT AT 0,7;S;AT 0,29;L1
3030 PRINT AT 1,0;
3040 PRINT TAB 12;"DEATH RACE"
3050 PRINT TAB 12;"██████████"
3060 PRINT "YOUR SCORE=";S
3070 IF S>HS THEN GOTO 3200
3080 PRINT "HI-SCORE=";HS
3090 PRINT "HELD BY ";H$
3100 PRINT
3110 PRINT "PRESS ANY KEY..."
3120 PAUSE 4E4
3130 GOTO 80
3200 PRINT "WHAT IS YOUR NAME?"
3210 INPUT H$
3220 LET HS=S
3230 GOTO 3100
4000 CLS
4010 PRINT TAB 13;"DEATH RACE"
4020 PRINT TAB 13;"██████████"
4030 PRINT "    1983 M.D.SAMUELS
ZX81 16K RAM"
4040 PRINT
4050 PRINT "THE OBJECT OF THE GA
ME IS TO     DODGE THE BLACK BLOC
KS AND HIT   THE GREY BLOCKS."
4060 PRINT
4070 PRINT "USE KEY 1 TO MOVE UP
, AND KEY A TO MOVE DOWN."
4080 PRINT ,,"PRESS ANY KEY.."
4090 PAUSE 4E4
4100 RETURN
7000 SAVE "DEATH RACE"
7010 RUN
```

At last!

Over the past year there has been much speculation on the design and capabilities of the Microdrives. Chris Palmer investigates.



It's hard to believe it's finally here. After long months of waiting and speculating, the ZX Spectrum Microdrive has finally appeared. By the time you read this, thousands of people will be exploring the delights of these little black boxes.

So, what do you get for your money? First off it will not be any good buying a Microdrive on its own. The reason for this is that the operating system is contained in ROM on another device called the Interface 1. It is these two units we will be looking at in this review.

First moves

So having paid £29.95 for the Interface and £49.95 for the Microdrive, what do you do with them? The first move is to connect the Interface to the Spectrum. The Interface takes the form of a long black plastic box. It is the same width as the Spectrum, about two inches deep and the same height. Raised out of the back of the Interface is the connector. This plugs into the Spectrum's expansion socket, placing the rest of the Interface underneath the body of the Spectrum. It is possible to permanently attach the Interface to the Spectrum by removing the two screws from the back of the Spectrum's case and replacing them with the screws which are included in the Interface.

On the left side of the Interface is a cutaway slot which houses an edge connector. Onto this you push one end of the ribbon cable supplied with the Interface. This will provide the link to the Microdrive. One thing to be very careful of is which way round you attach the cable. Because the connector isn't keyed, it is possible to reverse the connections on each end. If you power up the system with these connections reversed then you can almost certainly say goodbye to the Microdrive and possibly the Spectrum as well. Needless to say we did not test this eventuality!

Interface 1 uses do not stop at controlling the Microdrive, however. For your money you also get an RS232 interface and a network capability. From left to right across the back of the Interface you have the following ports: Spectrum expansion port (this is simply a repitition of the port on the back of the Spectrum and will allow the connection of other Spectrum peripherals as normal), two 3mm jack sockets for the network and a 9 pin D-type socket for the connection to RS232 peripherals. More of these later.

The Microdrive

The Microdrive is about the size of two cigarette packets placed on top of each other. On either side of it are the slots into which the ribbon cable connectors fit. The rest of the case is unbroken save for a tiny slot on the front into which goes the cartridge and an L.E.D. Contained with the drive is the control circuitry, motor and read/write head.

When the Microdrives were first hinted at we were led to believe that they were to be smaller brothers to the 5¼" disc drives which were available for other micros. Not so. The Microdrives use a system not a million miles removed from the old eight-track cartridge players. That is to say that inside each cartridge is twenty feet of tape, joined in an endless loop. This is hard to visualise at first because the cartridge is about the size of a match box and only a couple of millimeters deep.

At first sight the cartridges have a very fragile appearance, but they seemed to stand up to the punishment which was inflicted upon them during the review. Sinclair Research

Fig. 1. Microdrive commands.

CAT 1	Provides a catalogue of all the files on drive one.
LOAD * "m";1;"name"	Loads the file called 'name' from drive one.
SAVE * "m";1;"name"	Saves the file called 'name' to drive one.
MERGE * "m";1;"name"	Merges the file called 'name' into the program in memory.
ERASE "m";1;"name"	Erases the file called 'name' from drive one.
FORMAT "m";1;"name"	Formats a blank cartridge and gives it the name 'name'.
OPEN #4;"m";1;"name"	Opens a data file called 'name' on drive one.
VERIFY"m";1;"name"	Verifies the program called 'name' on drive one.
RUN	When typed after a NEW, RUN will load the file called 'run' on Microdrive one.

Fig. 2. RS232 connections.

Pin 1 — No connection.	Pin 5 — CTS (output).
Pin 2 — TX data (input).	Pin 6 — No connection.
Pin 3 — RX data (output).	Pin 7 — Ground.
Pin 4 — DTR (input).	Pin 8 — No connection.
	Pin 9 — +9v.

claim the tape will remain stable for at least 5,000 accesses, but given the fragility of the system I think it would be necessary to keep back-up copies of your software.

Storage capacity for the cartridge can be anything between 80K and 100K. The cause of this imprecise figure is due to the action of the Microdrive when formatting a new cartridge. When you do this the cartridge is checked for any faulty sectors on the tape. If one is found, the tape will be marked to prevent from using this bit. On average, the cartridge usually comes out of formatting with around 90K clear. If this figure is below 80K then Sinclair Research will replace the cartridge.

One slightly worrying point about the operation of the cartridge is that the read/write head stays in contact with the tape at all times. Given that the tape runs at 30 ips you would think that head wear would be a major problem. However, the Sinclair Research engineers claim that the head should remain intact for the active life of the unit. It could also be quite horrific if the tape broke. You would end up with five or six feet of tape in the drive before you even knew that something was wrong!

Access times off the drive are quite fast. The entire loop will pass through the drive in ten seconds. For a 48K program the loading time can be as small as four seconds, but this depends a lot on where the head is positioned in relation to the start of the program. The speed of the drive is best illustrated by loading a SCREEN$. Where as off tape the picture builds up painfully slowly, on the Microdrive it looks very much like someone has opened a venetian blind over the screen. Very impressive.

The software

As I mentioned earlier, the Interface contains the drive operating system. Fitting the Interface now gives meaning to all those keywords which you've had on your Spectrum since you bought it and have not been able to do anything with. For a list of the new commands and their syntax take a look at Fig. 1.

Because the network, cassette and Microdrive share some of the same keywords it has become necessary to add some quite long-winded syntax to them. For instance, if you want to load a file from the Microdrive you have to issue the following command:

LOAD * "m";1;"name".

The first part tells the computer it is going to load a file, the star tells it that it is one of the new commands, the "m" indicatates that the file is coming from a Microdrive, the one tells it which Microdrive and the "name" is the file name. As I said, long-winded, but you get used to it quite quickly.

As well as supporting program files, the Microdrive will also support data files. These are created using the OPEN # command. Using this you can store data sequentially on the cartridge. This is a very fast way of storing a lot of data.

Due to the nature of the data storage system you cannot have random access files. A random access file is a file in which you can access a piece of information without having to read all the items before it in the file. To simulate this sort of file using the Microdive you would first have to read the entire file into the computer's memory and search for the information you want there.

You can find out what is contained on the cartridge by using the CAT command. Using this command will cause the drive to read the entire cartridge and make a note of the files it finds. It will then display the file names on the screen, along with the name of the cartridge and how many kilobytes of store are left.

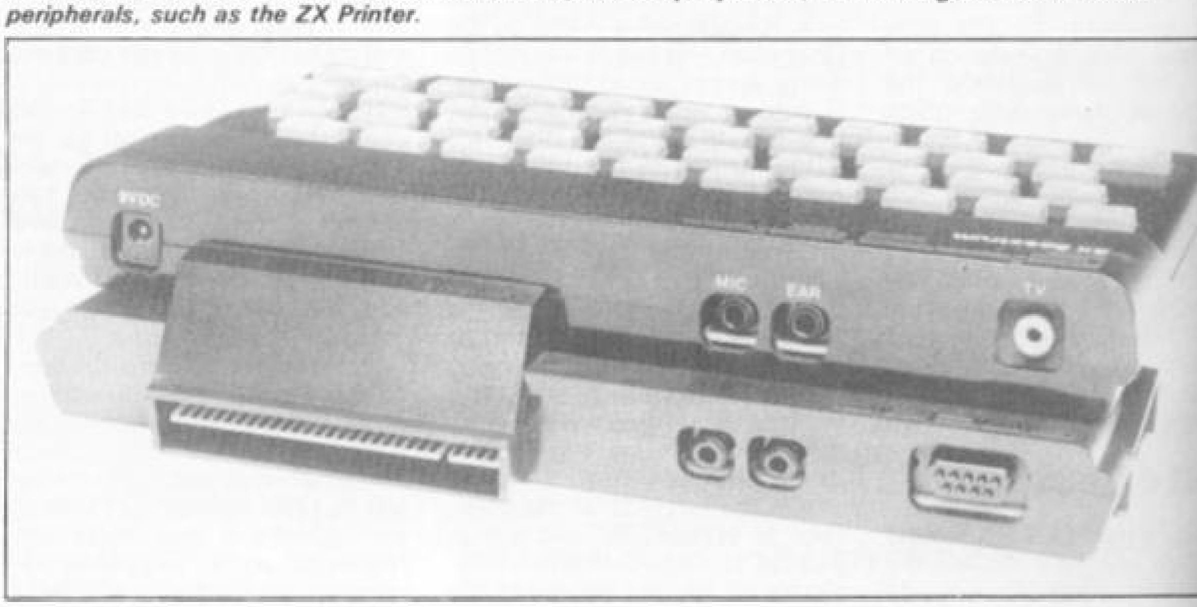
You are not restricted to just one Microdrive. You can, in fact, link up to eight drives to the Spectrum. At first it was thought that with eight drives attached, the drain on the Spectrum's power supply would be to much. However, when you study the command set it becomes obvious that only one drive can be active at a time. Whilst this is good in as much as you won't melt down your power supply, it does mean that you will not be able to make direct drive-to-drive copies. This means that backing-up your cartridge could become a little tedious, especially if you have a lot of small programs on it. The cartridges have a small tab on the side which can be broken off in the same way as the 'record-protect' tabs on cassette tapes. Doing this will make the whole cartridge read-only.

The network

One aspect of the Interface which should excite any educational Spectrum users is the network. By plugging together Spectrums using the jack-to-jack cable supplied you are able to link between two and 64 Spectrums into a network. Once this has been set up you can send and receive data between any or all the Spectrums which are active on the network. You can also use a peripheral attached to one Spectrum from a completely different Spectrum.

It is also possible to broadcast a program from one Spectrum and have all the machines on the network receive it.

The Interface 1 unit is attached to the Spectrum via the edge connector. Sockets are included on the Interface 1 unit to allow for the ZX Microdrives, RS232 peripherals, networking and other Sinclair peripherals, such as the ZX Printer.



Once established, each Spectrum on the net is given a number by using the FORMAT command. Having assigned identifiers to all the Spectrums you can then SAVE and LOAD programs between then using the SAVE * and LOAD * commands. In fact, all the operations carried out over the net are similar to the operations used to move data and programs to and from the Microdrive. Once again the data transfer rate is extremely high. A SCREEN$ takes only a few seconds to be sent and received.

The RS232

The final function of the Interface is to provide a standard RS232 interface channel. Using this you can send and receive information from your Spectrum to printers, modems and even different sorts of computers. Figure 2 shows the pin-out specification for the Spectrum's RS232. By using the network in conjuction with a single RS232 compatable printer hooked up to one Spectrum, that Spectrum can then print out anything sent to it from anyone of the other Spectrums.

To compliment the RS232, Sinclair Research can also supply a ready-made interface lead which has the 9 pin D-type one end and a 25 pin D-type on the other. This will be useful as most RS232 peripherals have this sort of connection.

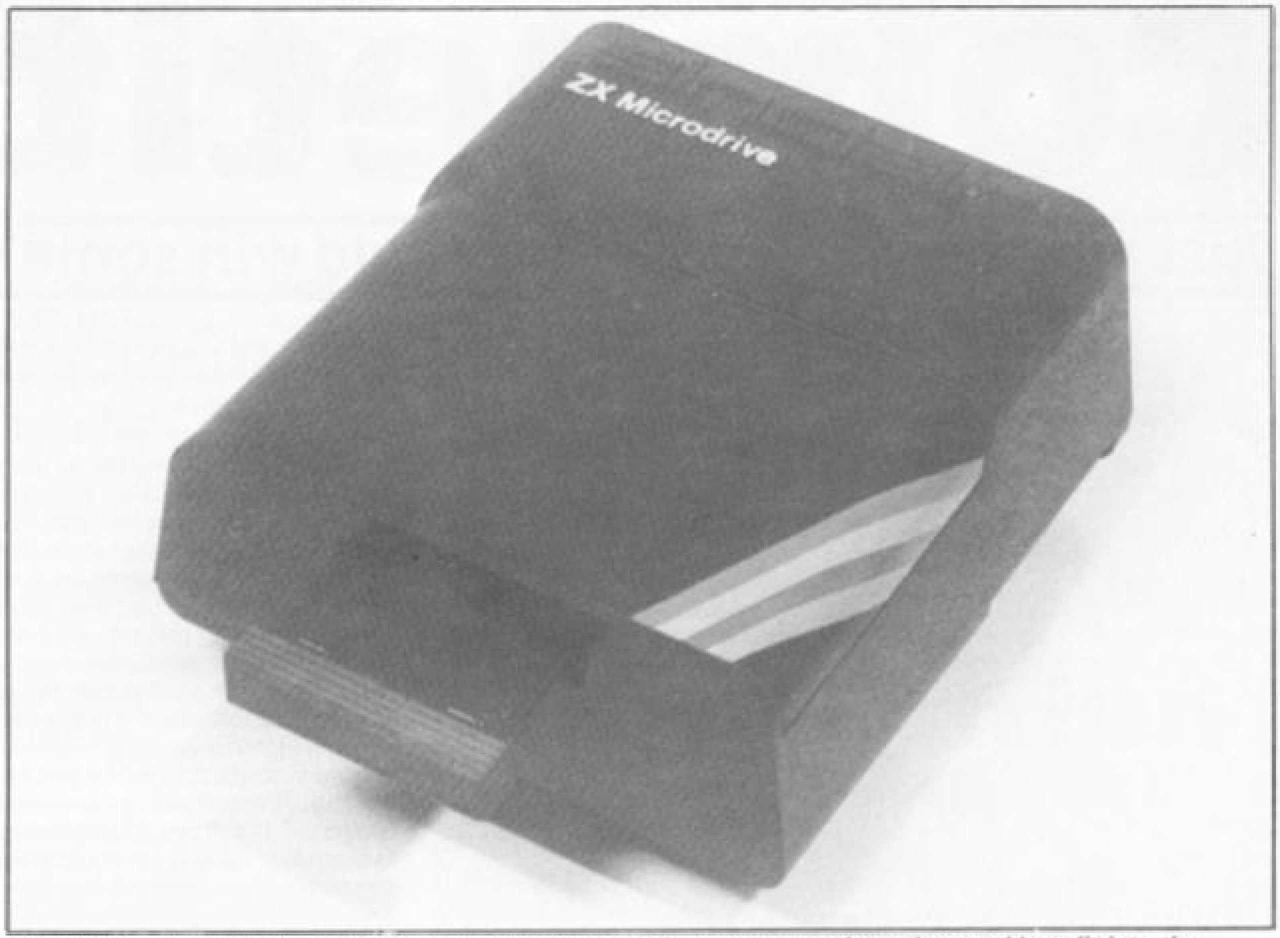
The conclusion

Overall, I was impressed by the compactness and the thought behind the Microdrive/Interface system. Whilst it is not as powerful as some others and the control of the system tends to be long-winded, there is certainly nothing to touch it for price.

So, what effect will the Microdrive have one the software market? I can see two possible outcomes. First it will be a great help to anyone who likes adventures. Just think of the possibilities in an adventure which can be up to 148K long.

Wordprocessor, database and accounting programs will also now become a viable addition to the Spectrum library. Arcade style games can be made more complex. As soon as you finish one section, the next is loaded off the drive.

That's the positive side. The negative side to the Microdrive is that software will

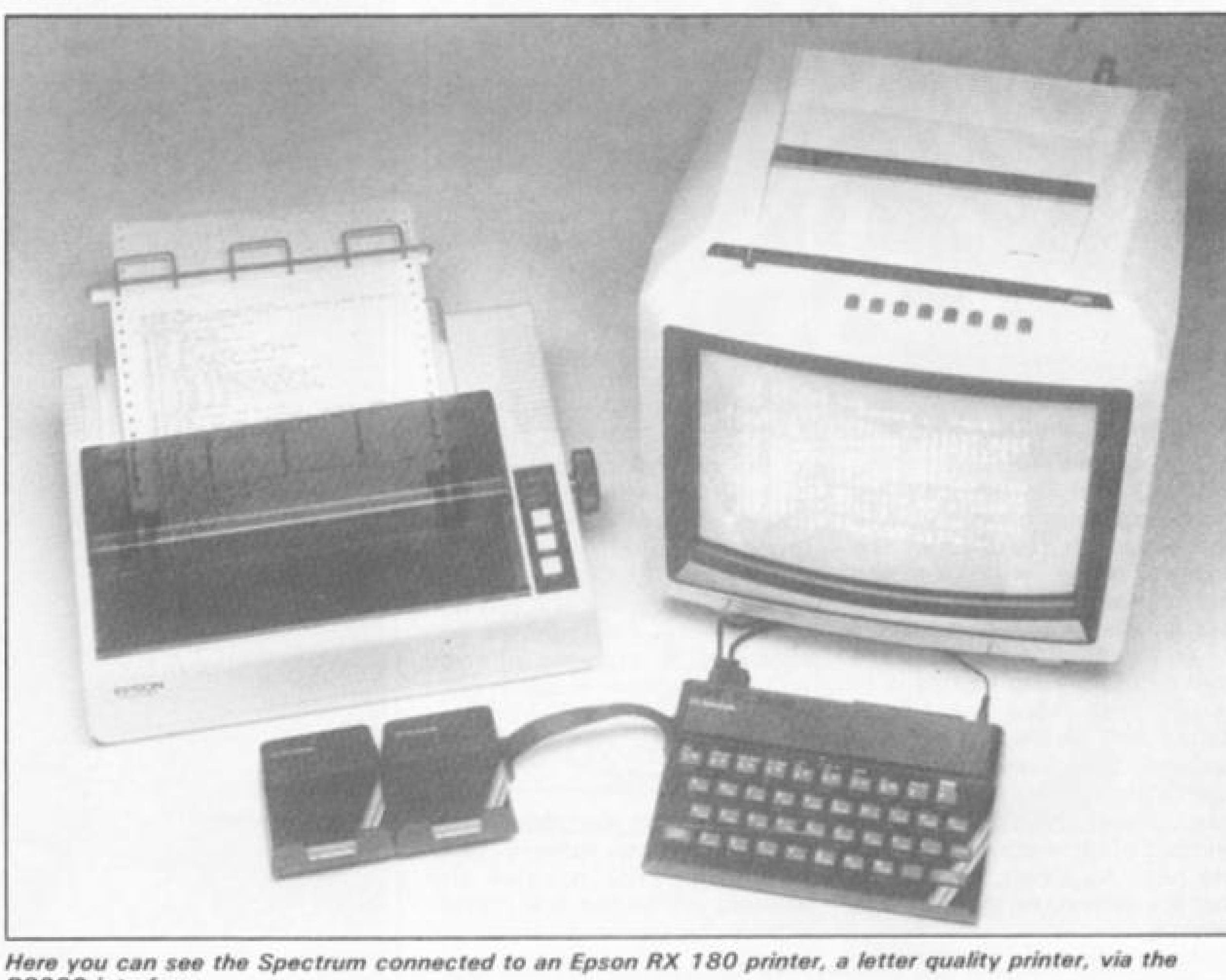


The ZX Microdrive in all its splendour. In this photograph, you can see how the cartridges fit into the front of the drive unit.

cost more if it is supplied on cartridge. This is because a cartridge costs a lot more than a tape in the first place and it will also cost a lot more to duplicate them. This might mean that only the larger software companies will be able to afford the expense of producing for the Microdrive. So don't throw away your tape recorder just yet!

To conclude, I liked the Microdrive and I was sorry to see the review sample disappear back to Sinclair Research.

One last point. When will other computer manufacturers follow Sinclair Research's lead and provide similar facilities for their underprivileged users?



Here you can see the Spectrum connected to an Epson RX 180 printer, a letter quality printer, via the RS232 interface.

Competition

Just for the record . . . you could win some software here!



Pete Shelley, sporting his techno-flash sweater.

As you seem to have had some fun with last issue's competition, judging from the stream of entries we've received in the editorial office, we're keeping the 'cartoon' theme going for this issue's competition.

All you have to do to stand a chance of winning a prize is to study the two cartoons reproduced below. They may look the same when you first look at them, but if you look a bit more carefully you'll find a number of differences between the two. As a hint, I'll tell you that the cartoon on the left is the original.

To enter this competition, circle around the areas different to the original cartoon on the cartoon on the right. Then, when you are sure you have found all the differences, fill in the coupon at the top of the cartoon, cut it out and put it in an envelope. Now, before you send it off to us, make sure you write the number of differences you have found on the back of the envelope.

The prizes

There will be ten first prize winners and ten runners-up to this competition, and the winners will be the first correct entries picked out of a hat (providing we've got one big enough!) at random.

The ten first prize winners will receive the very successful solo LP by Pete Shelley called XL1, Chris Sievey's single Camouflage, and the single, Talk To Me, by Mainframe. The ten runners-up will receive copies of the two singles by Chris Sievey and Mainframe. All the prizes will be signed by the artists.

Pete Shelley, as a Spectrum user, decided it would be nice to illustrate some of the songs on his new album with the lyrics on-screen. Having written a BASIC program to do roughly what he wanted, Pete then consulted a friend of his from Manchester University, Joey, who transformed his idea into machine code. The final program looks great, with the lyrics of the song flashing across the screen as they're sung on the record. The songs are excellent as well - it's no surprise XL1 has done so well in the LP charts!

Chris Sievey's single, Camouflage, contains three programs for the ZX81 on the flip-side. The first illustrates the lyrics to his song on the A-side, and the other two are games programs, one for the 16K and one for the 1K ZX81. These games are versions of an arcade-type game called Flying Train.

Last but not least comes the



John Molloy and Murray Munro of Mainframe.

single from Mainframe called Talk To Me. This single contains programming material for the ZX81 and Spectrum, as well as something for the Apple and BBC Micro.

Rules

- This competition is open to all UK and Northern Ireland readers of *ZX Computing* except employees of Argus Specialist Publications Ltd, their printers and distributors, employees of Island Records, employees of EMI Records (UK), employees of MC² Music, or anyone else associated with the competition.
- As long as the correct coupon is used for each entry, there is no limit to the number of entries from each individual.
- All entires must be postmarked before November 30, 1983. The first prizes will be awarded to the first ten correct entries picked at random. The second prizes will be awarded to the next ten correct entries picked at random.
- The winners will be picked by the Editor of *ZX Computing*. No correspondance will be entered into with regard to the results, and it is a condition of entry that the Editor's decision is accepted as final.
- The winners will be notified by post and the results of the competition will be published in a future issue of *ZX Computing*.

Address your entries to:

ZX Computing — spot the difference,
145 Charing Cross Road,
London WC2H 0EE.

Results

Firstly, thank you everyone for sending in your limericks — they were all better than my feeble example limerick.

However, someone must win and I'm afraid quite a few of you must lose (but there's always another time!). For the best limerick entry, the £50 prize of Sinclair Research software must go to CR Jackson of Blackburn, Lancashire. The two runners-up are Garry Copeland of Stafford and TE Burbis of London SW14 who will receive £30 and £20 respectively of Sinclair Research software.

Congratulations to all three of you.



Chris Sievey demonstrating the graphics on his Camouflage single.

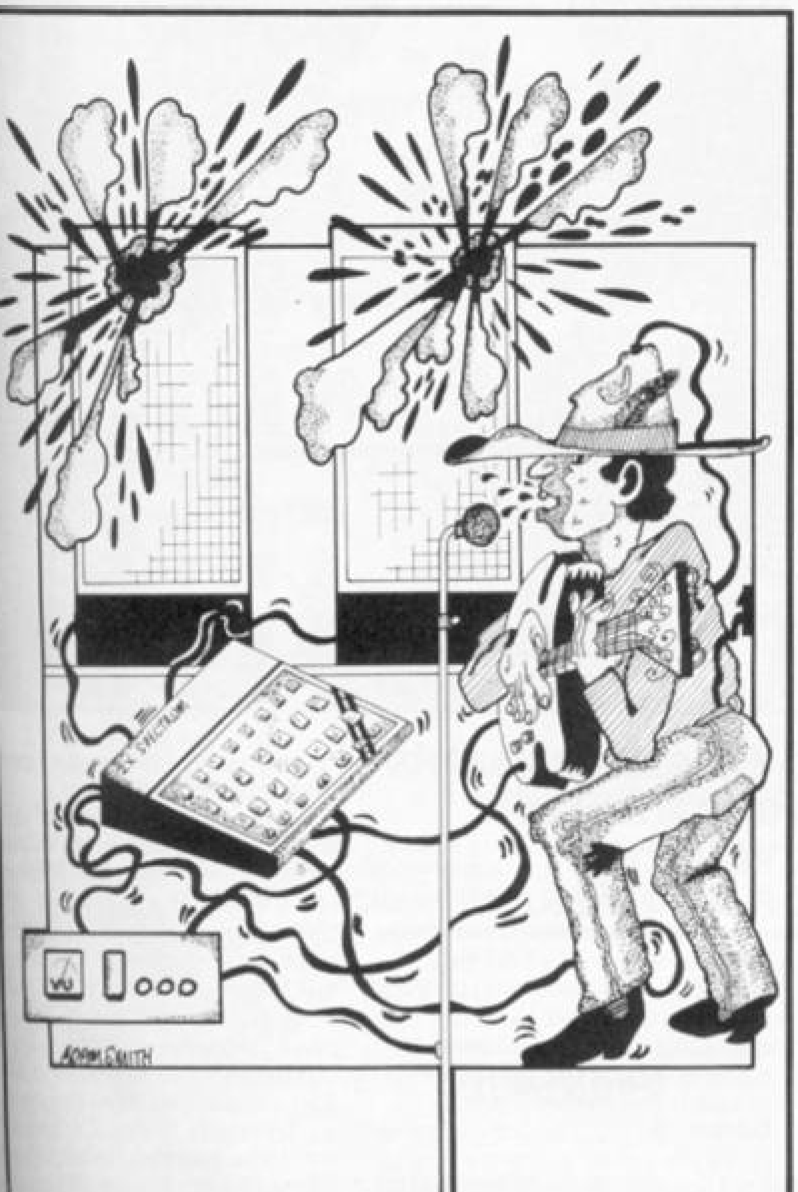
Competition

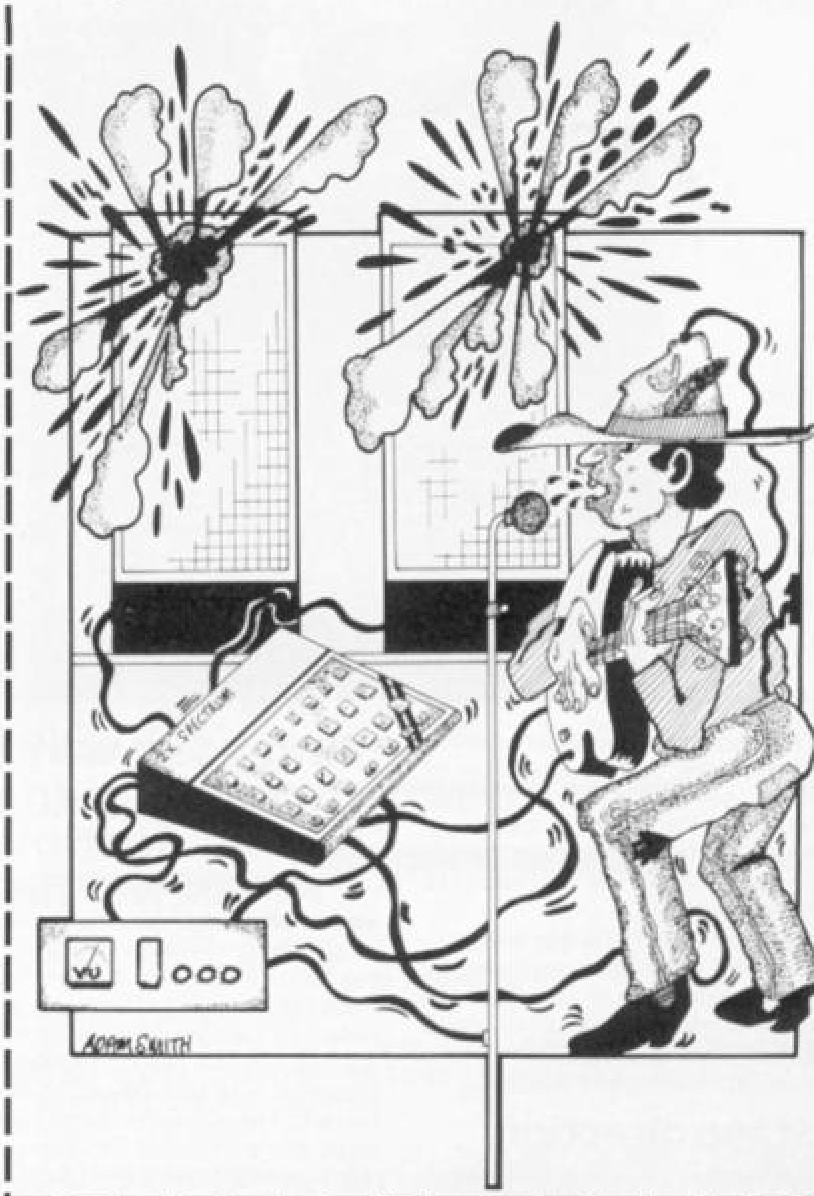
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Address . . . .

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Spider's web



Find your way to freedom in this challenging program from Nicholas Wilding of Henley-on-Thames.

This game occupies just over 8K of memory, and is made up of three games which are inter-related. You are a common household spider whose task is to escape from the bathroom to freedom.

When you RUN the program you will have a chance to see the instructions, but in order to understand the aims of each game, here follow some details that you might find helpful.

Stage direction

Game 1 — Two deadly drips are forever destined to fall down the plughole from which you are trying to escape. You must avoid these drips by sheltering in the hideouts which are randomly situated in the pipe. In order to progress up the plughole you have to emerge from these hideouts. As you enter each one of the five new screens of plughole you encounter, your starting position will always be safe.

Game 2 — By swinging on your web, you can avoid the obstacles both one and two squares below the spider's eyes to reach the bathroom floor.

Game 3 — The third game gives the spider a chance for the final escape. In order to exit by the bathroom door (a graphic 'D') the spider must avoid obstacles in its path.

The spider may collect up to three of these obstacles without losing a life. However, it is best to avoid them for if the bathroom door can no longer be seen (ie it is closed) the spider will need to collect an extra obstacle to re-open it. If you have already collected three obstacles, you will lose a life; you are allowed three lives only.

To reach Game 2, Game 1 has to be mastered, and to reach Game 3, both preceeding games must be completed.

Program description

Here follows an explanation as to how the program works:

Lines 10-70	Ask if instructions are needed (line 15) and set up the variables needed for Game 1.
Line 100	Prints the spider (S$).
Lines 110-150	Move the drips down one square, and check whether the spider has been hit.
Line 160	Checks to see if the spider has completed a screen of the plughole.
Lines 165-210	Move the spider if a key has been pressed.
Lines 1000-1090	Draw a screen of the plughole.
Lines 1100-1160	Set up the co-ordinates of the two drops.
Lines 2000-2030	Inform you that you have been killed. An endless loop.
Lines 3000-3170	Congratulate you on completing the first stage of the game, and ask if you wish to continue — if not the program ends in an endless loop (lines 3160 and 3170).
Lines 4000-4030	Initialise the variables used in Game 2.
Lines 4100-4160	Form the main Game 2 loop.
Lines 4415-4570	Swing the spider across the screen if required.
Lines 5000-5020	Make the words and score fit with the 'doom message' in lines 2000 to 2030.
Lines 5100-5199	Congratulate the player on completing Game 2 and introduce you to Game 3.
Lines 5200-5298	Draw the screen border for Game 3.
Lines 5300-5385	Print more obstacles on the screen.
Lines 5400-5490	Print the spider on the screen and check if it has bumped into a graphic character (bathroom obstacle).
Lines 5500-5595	Inform you that you are lumbered with another obstacle and print another door on the screen.
Lines 5600-5610	Form an endless loop telling you that you're dead.
Lines 5700-6150	Draw the 3D bathroom door and make the spider walk out.
Lines 7000-7700	Form the instructions.
Lines 9980-9990	Make the program self-RUN. (When SAVEing the program, type GOTO 9980.)




```
   5 REM █      NICHOLAS WILDING █
   7 REM               SPIDER
   9 CLS
  10 RAND
  15 GOSUB 7000
  20 LET ULT=INT (RND*5)+1
  30 LET SC=0
  40 LET S$="▄█▄"
  50 GOSUB 1000
  60 GOSUB 1100
  70 GOSUB 1130
 100 PRINT AT X,Y;S$
 110 PRINT AT D1X,D1Y;" ";AT D2X
,D2Y;" "
 120 IF C>RND AND D2X<>20 THEN L
ET D2X=D2X+1
 130 IF D2X=20 THEN GOSUB 1130
 134 IF D1X<>20 THEN LET D1X=D1X
+1
 136 IF D1X=20 THEN GOSUB 1100
 140 PRINT AT D1X,D1Y;
 142 IF PEEK (PEEK 16398+256*PEE
K 16399)<>0 THEN GOTO 2000
 144 PRINT AT D2X,D2Y;
 146 IF PEEK (PEEK 16398+256*PEE
K 16399)<>0 THEN GOTO 2000
 150 PRINT AT D1X,D1Y;"▒";AT D2X
,D2Y;"▒"
 160 IF X=2 THEN GOSUB 1000
 165 IF INKEY$="" THEN GOTO 110
 167 PRINT AT X,Y;"   "
 170 PRINT AT X,Y-1;
 180 IF INKEY$="5" AND PEEK (PEE
K 16398+256*PEEK 16399)<>CODE "█
" THEN LET Y=Y-1
 190 PRINT AT X,Y+3;
 200 LET Y=Y+(INKEY$="8" AND PEE
K (PEEK 16398+256*PEEK 16399)<>C
ODE "█")
 202 IF INKEY$="7" AND Y>13 AND
Y<16 THEN LET X=X-1
 205 LET C=C+1
 210 GOTO 100
1000 LET SC=SC+1
1001 IF SC=5 THEN GOTO 3000
1002 CLS
1005 LET RND=INT (RND*9)+1
1010 FOR L=0 TO 21
1020 LET N$="██████████       █
█████████"
1030 LET RN=RND
1040 IF RN<.3 THEN LET N$="█████
█████        ██████████"
1050 IF RN>.7 THEN LET N$="█████
██████████       ██████████"
1055 PRINT N$
1060 NEXT L
1070 LET X=20
1080 LET Y=15
1085 PRINT AT X,Y;S$
1090 RETURN
1100 LET D1X=0
1110 LET D1Y=15+INT (RND*3)
1120 RETURN
1130 LET D2Y=15+INT (RND*3)
1140 LET D2X=0
1150 LET C=0
1160 RETURN
2000 CLS
2007 LET C$=" SCREENS"
2008 IF SC=1 THEN LET C$=C$(1 TO
 7)
2010 PRINT AT 10,0;"THE TERRIBLE
 DROP HAS KILLED YOU"
2015 PRINT AT 15,3;"YOU WENT THR
OUGH ";SC;C$
2020 PRINT AT 5,13;"OUCH";AT 5,1
3;"OUCH"
2030 GOTO 2020
3000 CLS
3010 FOR Q=1 TO 15
3020 PRINT "█";TAB 31;"█"
3030 NEXT Q
3040 PRINT "▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄   ▄▄▄
▄▄▄▄▄▄▄▄▄▄▄▄"
3050 FOR Q=1 TO 6
3055 PRINT "█████████████████   ███
████████████"
3060 NEXT Q
3070 FOR Q=21 TO 10 STEP -1
3080 PRINT AT Q,14;S$;AT Q,14;"
  "
3090 NEXT Q
3100 PRINT AT 12,0;"CONGRATULATI
ONS-YOU HAVE MADE IT";AT 12,0;"C
ONGRATULATIONS"
3110 PRINT
3120 PRINT TAB 0;"DO█YOU█WISH█TO
█DESCEND█FROM█THE█████BATH█ONTO
█THE█FLOOR?"
```

```
3130 IF INKEY$="" THEN GOTO 3100
3140 IF INKEY$="Y" THEN RUN 4000
3150 PRINT
3160 PRINT AT 16,12;"OKAY BYE";A
T 16,12;"OKAY,BYE"
3170 GOTO 3160
4000 CLS
4001 PRINT AT 10,0;"INPUT HEIGHT
 OF BATH (100-1000)"
4002 LET V=0
4003 INPUT R
4004 PRINT AT 10,0;"
                               "
4006 LET S$="▄▀▀▄"
4010 LET X=10
4020 LET Y=15
4030 PRINT AT 4,0;"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
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▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
4100 LET A=CODE INKEY$
4105 IF V>=R THEN GOTO 5100
4110 IF A<>0 THEN GOSUB 4500
```




```
4120 PRINT AT 21,INT (RND*31)+1;
CHR$ (INT (RND*9)+1)
4130 PRINT AT X,Y;S$;AT X-1,15;"
█ "
4135 SCROLL
4137 PRINT AT X+1,Y+1;
4140 LET L=PEEK (PEEK 16398+256*
PEEK 16399)
4145 IF L<11 AND L>0 THEN GOTO 5
000
4155 LET V=V+1
4160 GOTO 4100
4415 IF L=0 THEN GOTO 5000
4500 LET Z=X
4502 LET T=1
4505 IF A<33 THEN LET T=-1
4510 FOR B=15 TO (A-18) STEP T
4520 LET Z=Z-1
4530 PRINT AT Z+1,B+1;
4540 IF PEEK (PEEK 16398+256*PEE
K 16399)<11 AND PEEK (PEEK 16398
+256*PEEK 16399)>0 THEN GOTO 500
0
4545 LET V=V+1
4550 PRINT AT Z,B;S$;AT Z,B;" █
"
4555 SCROLL
4560 NEXT B
4570 RETURN
5000 LET C$=" TURNS"
5010 LET SC=V
5020 GOTO 2015
5100 FOR A=1 TO 200
5110 PRINT AT INT (RND*20)+1,INT
 (RND*21)+1;"WELL DONE"
5120 NEXT A
5130 CLS
5135 GOTO 5150
5140 LET TIME=RND*RND*RND*RND*RN
D*RND*RND*99*RND*RND*RND*RND*RND
5145 RETURN
5150 PRINT AT 5,0;"N";
5155 GOSUB 5140
5160 PRINT "O";
5165 GOSUB 5140
5170 PRINT "W";
5175 GOSUB 5140
5180 PRINT ",";AT 10,5;"ESCAPE "
;
5185 GOSUB 5140
5190 PRINT "FROM THE ";
5195 GOSUB 5140
5197 PRINT "BATHROOM"
5198 PAUSE 150
5199 CLS
5200 LET S$="▣"
5210 LET S1=1
5220 LET S=1
5230 FOR A=0 TO 31
5240 PRINT AT 0,A;"▒"
5250 NEXT A
5260 FOR A=0 TO 31
5270 PRINT AT 20,A;"▒"
5280 NEXT A
5290 FOR A=1 TO 19
5292 PRINT AT A,0;"▒";AT A,31;"▒
"
5295 NEXT A
5296 PRINT AT S,S1;S$;AT INT (RN
D*5)+14,INT (RND*5)+24;"▣"
5297 LET A1=3
5298 LET H=0
5300 FOR A=1 TO A1
5310 LET O=INT (RND*20)+1
5320 LET O1=INT (RND*30)+1
5330 PRINT AT O,O1;
5340 IF PEEK (PEEK 16398+256*PEE
K 16399)=151 THEN GOSUB 5500
5350 PRINT AT O,O1;CHR$ (INT (RN
D*11)+128)
5360 NEXT A
5370 LET T=S
5380 LET T1=S1
5385 GOTO 5400
5390 LET C=PEEK (PEEK 16398+256*
PEEK 16399)
5395 RETURN
5400 LET T=T+(INKEY$="6")-(INKEY
$="7")
5410 LET T1=T1+(INKEY$="8")-(INK
EY$="5")
5420 PRINT AT T,T1;
5430 GOSUB 5390
5440 IF C=169 THEN GOTO 5700
5445 IF C>127 THEN GOSUB 5500
5450 PRINT AT S,S1;" "
5460 IF C=8 THEN GOTO 5480
5470 LET S1=T1
5475 LET S=T
5480 PRINT AT S,S1;S$
5490 GOTO 5300
5500 LET H=H+1
5510 IF H=3 THEN GOTO 5600
5515 PRINT AT INT (RND*5)+15,INT
 (RND*5)+26;"▣"
5520 PRINT AT 21,0;"YOUR NOW LUM
BERED WITH ";
5530 LET Z=INT (RND*10)+1
5540 IF Z=1 THEN PRINT "A TOWEL
 "
5550 IF Z=2 THEN PRINT "SOME SOA
P"
5555 IF Z=4 THEN PRINT "A COMB
 "
5560 IF Z=5 THEN PRINT "A BRUSH
 "
5565 IF Z=6 THEN PRINT "A GLASS
 "
5570 IF Z=7 THEN PRINT "A RAZOR
 "
5575 IF Z=8 THEN PRINT "A SPOON
 "
5580 IF Z=9 THEN PRINT "A FLANNE
L"
5585 IF Z=10 THEN PRINT "SHAMPOO
 "
```



```
5590 LET A1=A1+1
5595 RETURN
5600 PRINT AT INT (RND*20)+1,INT
 (RND*15)+1;"OUCH YOUR DEAD"
5610 GOTO 5600
5700 CLS
5710 FOR A=5 TO 19
5720 PRINT AT A,10;"██████████"
5730 NEXT A
5740 PRINT AT 12,17;"███"
5750 PRINT AT 5,20;"▄███▄";AT 19
,20;"▄▄▄▄▄"
5760 PRINT AT 5,5;"▄▄▄▄▄▄";AT 19,
5;"▄▄▄▄▄ "
5780 FOR A=0 TO 4
5790 PRINT AT A,A;"▚"
5800 NEXT A
5805 LET B=0
5810 FOR A=29 TO 25 STEP -1
5820 PRINT AT B,A;"▞"
5825 LET B=B+1
5830 NEXT A
5840 LET B=4
5850 FOR A=20 TO 21
5860 PRINT AT A,B;"▞"
5870 LET B=B-1
5880 NEXT A
5890 LET B=25
5900 FOR A=20 TO 21
5910 PRINT AT A,B;"▚"
5920 LET B=B+1
5930 NEXT A
5940 FOR A=6 TO 18
5950 PRINT AT A,5;"▌";AT A,24;"▐
"
5960 NEXT A
5970 FOR A=5 TO 19
5980 PRINT AT A,17;"██ "
5990 NEXT A
6000 PRINT AT 12,17;"██"
6010 FOR A=21 TO 19 STEP -1
6020 PRINT AT 20,A;"▞▀▚"
6025 FOR B=1 TO 10
6027 NEXT B
6028 PRINT AT 20,A;"   "
6030 NEXT A
6040 PRINT AT 19,19;"█▚▖"
6050 LET SS=RND*RND*RND*RND*RND*
RND*RND*RND*RND*RND*RND*RND*RND
6060 PRINT AT 19,19;"▚▖"
6070 FOR A=1 TO 25
6075 NEXT A
6080 PRINT AT 19,19;" ▖"
6090 FOR A=5 TO 19
6100 PRINT AT A,18;"██"
6110 NEXT A
6120 PRINT AT 12,17;"███"
6140 PRINT AT 12,10;"[illegible]"
6150 GOTO 6140
7000 PRINT AT 5,5;"[illegible]"
7010 IF INKEY$="" THEN GOTO 7010
7020 IF INKEY$="N" THEN RETURN
7030 CLS
7040 PRINT AT 5,5;"GAME 1...1";A
T 7,5;"GAME 2...2";AT 9,5;"GAME
3...3";AT 11,5;"SCORING..4";AT 1
3,5;"TO BEGIN.5"
7050 LET A$=INKEY$
7060 IF A$="" THEN GOTO 7050
7070 IF CODE A$-28<1 OR CODE A$-
28>5 THEN GOTO 7050
7075 CLS
7080 GOTO ((CODE A$-28)*100)+700
0
7100 PRINT TAB 5;"GAME 1-THE PLU
GHOLE"
7110 PRINT "BEWARE OF THE DRIPS
AND MAKE IT THROUGH 5 SCREENS OF
 PLUGHOLE."
7120 PRINT "        DIRECTIONS:"
7130 GOSUB 7600
7132 GOSUB 7630
7134 GOSUB 7660
7140 PRINT AT 21,10,"PRESS ANY K
EY"
7150 GOTO 7550
7200 PRINT TAB 5;"GAME 2-THE BAT
H"
7210 PRINT "SWING ON YOUR WEB TO
 AVOID THE  OBSTACLES PLACED IN
YOUR PATH"
7220 PRINT "        DIRECTIONS:"
7230 PRINT AT 6,0;"1      -      F
OUR SWINGS LEFT  2      -      T
HREE SWINGS LEFT   3     -     T
WO SWINGS LEFT     4     -     O
NE SWING LEFT"
7240 PRINT AT 11,0;"5        -
NEUTRAL POSITION"
7250 PRINT AT 13,0;"6        -
ONE SWING RIGHT      7     -
TWO SWINGS RIGHT     8     -
THREE SWINGS RIGHT   9     -
FOUR SWINGS RIGHT"
7260 GOTO 7140
7300 PRINT TAB 5;"GAME 3-THE BAT
HROOM"
7310 PRINT "ESCAPE FROM THE BATH
ROOM BEFORE YOU ARE LUMBERED WIT
H 3 OBJECTS"
7320 PRINT "        DIRECTIONS:"
7330 GOSUB 7600
7340 GOSUB 7630
7350 GOSUB 7660
7360 GOSUB 7690
7370 PRINT AT 21,10;"PRESS ANY K
EY"
7380 GOTO 7550
7400 PRINT TAB 5;"SCORING"
7410 PRINT AT 5,0;"GAME 1 - SCRE
ENS PASSED";AT 10,0;"GAME 2 - HO
W FAR DOWN BATH";AT 15,0;"GAME 3
 - MOST NUMBER OF DOORS ON
         SCREEN LOSES"
7420 PRINT AT 21,10;"PRESS ANY K
EY"
7430 GOTO 7550
7500 RETURN
7550 IF INKEY$="" THEN GOTO 7550
7570 GOTO 7030
7600 PRINT AT 4,2;"▞";AT 5,1;"▞▄
▄";AT 6,1;"▚▄▄▄";AT 7,2;"▚"
7610 PRINT AT 6,6;".....5"
7620 RETURN
7630 PRINT AT 4,29;"▚";AT 5,27;"
▄▄▞";AT 6,27;"▄▄▄▞";AT 7,29;"▞"
7640 PRINT AT 6,20;"8.....  "
7650 RETURN
7660 PRINT AT 10,3;"▞▚";AT 11,2;
"▞█▚";TAB 3;"█ ";TAB 3;"█ "
7670 PRINT AT 13,6;".....7"
7680 RETURN
7690 PRINT AT 10,28;"█ ";TAB 28;
"█ ";TAB 27;"▚█▞";TAB 28;"▚▞"
7695 PRINT AT 13,20;"6....."
7698 RETURN
7700 STOP
9980 SAVE "SPIDER"
9990 RUN
```

Treasure trail

A party game with a difference from Clyde Bish of Exeter.



This program was written as a real-time adventure for my son's birthday and may be of interest to any readers who have the unenviable task of organising party entertainment for a room full of eight year olds who find 'Pass the parcel' and 'Musical bumps' rather tame.

The game has been written to accomodate five pairs, each having six locations to investigate but, of course, this could be extended to cover more locations and participants given the extra memory available. As it stands the program just fills the 16K ZX Spectrum.

Double trouble

The program has been written in two parts. The first section produces data files for answer words and clues without the need for carefully compiled and spaced data statements. This method of programming also has the advantage that a number of different data files could be produced to RUN on the main program.

Looking first at the data file program, this has been called Traildata. Type in and RUN the program, Traildata. The input prompt will ask first for the answer word (four letters only accepted), then clue A (the location) followed by clue B (where to look) for each of the six locations to be found by the five teams of players.

Examples of the clues could be:

Locations —

Part of the home but not in the house (garage).
Water in high places (bathroom).
The tiniest snores can be heard, here (nursery).

Where to look —

Don't throw this clue away (paper bin).
A tooth fairy might look here (under a pillow).
Getting wetter as it dries (towel).

These are only examples of the kind of clue you could use, but they could, of course, be adapted to suit the players involved in the game — you don't want to make it too easy do you!

After all the information required is entered and processed (see later on in the explanatory text), it should be SAVEd on tape and VERIFYed, ready to be LOADed into the main program, Trailgame.

Playing the game

Before the guests to the party arrive, you should make anagrams of the answer words, write them on pieces of card and stick them to the object that the specific location clue indicates. For example, if the answer word was 'mole' and the location is specified as the hoover in the hallway, then you could stick a piece of card with the word 'loem' onto the side of the hoover.

To play the game, a member of the team presses their team's colour code number (use the keys required to get that specific colour), and the program GOSUBs to that team's subroutine and displays the first pair of clues on the screen and direct to the printer.

Once the team have searched in the correct location, found the card and solved the anagram, they should press their colour code number again. As the answer flag is set, the program will wait for the answer to be input. If the answer proves correct, the team are congratulated and given their next pair of clues. If the wrong word is entered, the computer suggests that the team provide another answer — this also means that if the right word is mis-spelt when first typed in the team will not be punished too harshly for a mistake.

When a team have solved all six clues, the program heads for line 7000, and congratulations are forthcoming to the winning team.

To start the program, type RUN and you will find the Caps Lock is already set. If the program is stopped for any reason, the game can be re-started with the existing variables intact using GO TO 100. One other point to note is that the teams should not, in their enthusiasm, remove the cards from the locations you have so carefully hidden them in as they may turn out to be the wrong clues — encourage the teams to solve the clues at the hiding places.

In my experience of this game, it has managed to keep guests happy for at least 45 minutes — which is a long time at an eight year old's birthday party!

Program description

Here follows a brief breakdown highlighting the lines of major importance of the program, Traildata.

Line 10	(Blue team) The character array, b$, is DIMensioned to be large enough to take the answer word and longest location clue A using the variable, mxl, declared in subroutine 1000. c$ is DIMensioned similarly for clue B using the variable, mx2. The information is then fed into these arrays using the data in numeric arrays b and e to slice the string, x$, in which the information returns from subroutine 1000.
Lines 20-50	Each of these repeats the above procedure for arrays, r$ and a$ (red team), m$ and n$ (magenta team), g$ and h$ (green team) and y$ and z$ (yellow team).
Line 60	SAVEs the data in the above arrays on tape and VERIFYs it.
Line 1000	The subroutine starting here is called five times, once for each of the teams. The answer word is added to x$. Clue A is scanned by subroutine 2000 to space into PRINT lines of 32 characters (see below). Its length is checked against mxl, which it replaces if it is longer, before it is added to x$; the pointers for its beginning and end being held in arrays b and e. The procedure is then repeated for clue B. A FOR . . . NEXT loop runs this routine six times to take in all the clues for a team before RETURNing.
Line 2000	The subroutine starting here cuts each clue into 32 character lengths, adding spaces where necessary to avoid cutting a word into two when it is PRINTed up on the screen during a game.

The name of the game



You should now type in and RUN the program, Trailgame. Follow the prompts to LOAD in the data previously stored on tape from Traildata. The game is now ready to play. But before we get around to that, here is a brief breakdown of Trailgame:

Line 10	Sets the answer flags and clue answer counters to zero.
Lines 100-150	The title display and subroutine selection — the title, Treasure Trail, will constantly change colour until a number, the colour code of the team, is pressed. This variable, CC, is used to compute the GOSUB.
Lines 1000-1120	The blue team subroutine (lines 2000, 3000, 4000, and 6000 are the starts of the other team's subroutines). If the answer flag, BA, is not set, the next pair of clues are supplied on the screen and the printer. The answer flag is then set before the RETURN so that on a subsequent GO SUB to the routine the flow of the program is directed to the answer sequence (lines 1100 to 1120). A correct answer entered will result in the next clue being supplied, or a jump to the end routine at line 7000 if all the clues are answered correctly. If an inaccurate response is entered, the answer flag is left set for the team to try again.
Lines 8000-8500	These subroutines are used for prompts, etc, to save bytes.
Line 9000	This is a routine to LOAD in the arrays previously SAVEd on tape in the program, Traildata.

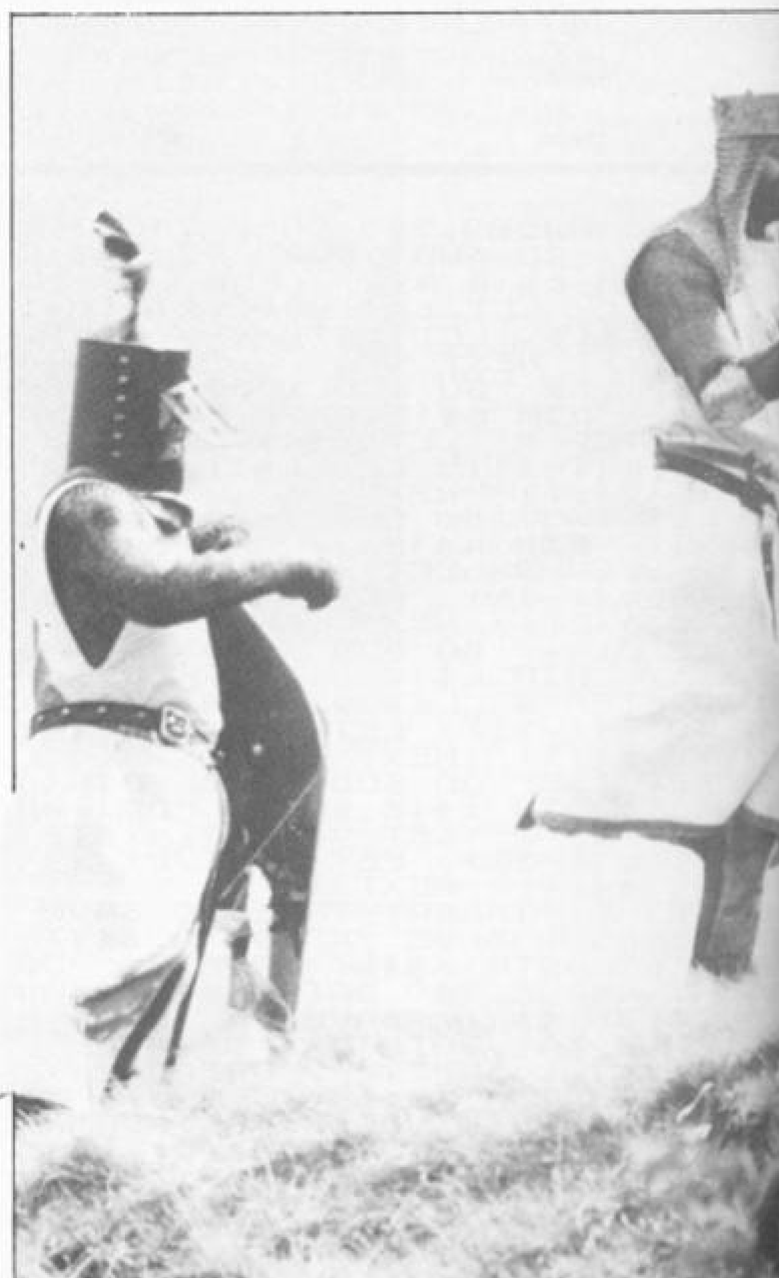
```
 10 POKE 23609,50: POKE 23653,8
: LET t=1: GO SUB 1000: DIM b$(6
,mx1): DIM c$(6,mx2): FOR i=2 TO
 12 STEP 2: LET b$(i/2)=x$(b(i-1
) TO e(i-1)): LET c$(i/2)=x$(b(i
) TO e(i)): NEXT i
 20 LET t=2: GO SUB 1000: DIM r
$(6,mx1): DIM s$(6,mx2): FOR i=2
 TO 12 STEP 2: LET r$(i/2)=x$(b(
i-1) TO e(i-1)): LET s$(i/2)=x$(
b(i) TO e(i)): NEXT i
 30 LET t=3: GO SUB 1000: DIM m
$(6,mx1): DIM n$(6,mx2): FOR i=2
 TO 12 STEP 2: LET m$(i/2)=x$(b(
i-1) TO e(i-1)): LET n$(i/2)=x$(
b(i) TO e(i)): NEXT i
 40 LET t=4: GO SUB 1000: DIM g
$(6,mx1): DIM h$(6,mx2): FOR i=2
 TO 12 STEP 2: LET g$(i/2)=x$(b(
i-1) TO e(i-1)): LET h$(i/2)=x$(
b(i) TO e(i)): NEXT i
 50 LET t=5: GO SUB 1000: DIM y
$(6,mx1): DIM z$(6,mx2): FOR i=2
 TO 12 STEP 2: LET y$(i/2)=x$(b(
i-1) TO e(i-1)): LET z$(i/2)=x$(
b(i) TO e(i)): NEXT i
 60 PRINT "INSERT TAPE TO SAVE
DATA FILES": SAVE "p" DATA b$():
 SAVE "p" DATA c$(): SAVE "p" DA
TA r$(): SAVE "p" DATA s$(): SAV
E "p" DATA m$(): SAVE "p" DATA n
$(): SAVE "p" DATA g$(): SAVE "p
" DATA h$(): SAVE "p" DATA y$():
 SAVE "p" DATA z$()
 70 CLS : PRINT "REWIND TAPE AN
D PLAY TO VERIFY  (If error mess
age appears type  GOTO 60 then p
ress ENTER to savedata again)":
VERIFY "" DATA b$(): VERIFY "" D
ATA c$(): VERIFY "" DATA r$(): V
ERIFY "" DATA s$(): VERIFY "" DA
TA m$(): VERIFY "" DATA n$(): VE
RIFY "" DATA g$(): VERIFY "" DAT
A h$(): VERIFY "" DATA y$(): VER
IFY "" DATA z$()
 80 CLS : PRINT "DO YOU WANT TO
 SAVE DATA AGAIN? PRESS Y OR N":
 PAUSE 0: CLS : IF INKEY$="Y" TH
EN GO TO 60
 90 STOP
1000 LET mx1=0: LET mx2=0: LET p
=1: LET x$="": DIM b(12): DIM e(
12): FOR n=2 TO 12 STEP 2: LET b
(n-1)=p
1002 INPUT "Enter word ";(N/2);"
 for player ";(t)' LINE a$: IF L
EN a$<4 OR LEN a$>4 THEN GO TO 1
002
1005 LET x$=x$+a$: INPUT "Enter
clue ";(n/2);"A for player ";(t)
' LINE a$: GO SUB 2000: IF LEN a
$+4>mx1 THEN LET mx1=LEN a$+4
1010 LET x$=x$+a$: LET e(n-1)=p+
LEN a$+3: LET p=e(n-1)+1: INPUT
"Enter clue ";(n/2);"B for playe
r ";(t)' LINE a$: GO SUB 2000: I
F LEN a$>mx2 THEN LET mx2=LEN a$
1020 LET x$=x$+a$: LET b(n)=p: L
ET e(n)=p+LEN a$-1: LET p=e(n)+1
: NEXT n: RETURN
2000 LET d$=""
2010 IF LEN a$<33 THEN GO TO 207
0
2020 LET b$=a$( TO 32): IF a$(33
)=" " THEN LET i=33: GO TO 2050
2030 FOR i=32 TO 1 STEP -1: IF b
$(i)=" " THEN GO TO 2050
2040 NEXT i
2050 LET d$=d$+b$( TO i-1)+"
        "( TO 33-i): LET a$=a$
(i+1 TO ): GO TO 2010
2070 LET a$=d$+a$: RETURN
```

The listing for the first part of the program, Traildata, which is used to input the various clues in the game.

```
   1 GO TO 9000
  10 POKE 23658,8: POKE 23609,50
: LET BA=0: LET RA=BA: LET MA=BA
: LET GA=BA: LET YA=BA: LET B=0:
 LET R=B: LET M=B: LET G=B: LET
Y=B
 100 FOR N=1 TO 6
 120 PRINT AT 4,0; INK N;"[illegible]
[illegible]"
 125 PRINT AT 10,0; INK N;"[illegible]
[illegible]";AT 11,0;"[illegible]
[illegible]";AT 12,0;"[illegible]
[illegible]";AT 13,0;"[illegible]"
 130 PRINT AT 17,1; BRIGHT 1; IN
K 0;"PRESS YOUR COLOUR CODE NUMB
ER"
 135 PAUSE 20
 140 IF INKEY$<>"" THEN GO TO 15
0
 145 NEXT N
 147 GO TO 100
 150 LET CC=VAL INKEY$: CLS : GO
 SUB CC*1000: GO TO 100
1000 BORDER 1: IF BA=1 THEN GO T
O 1100
1010 IF B=6 THEN GO TO 7000
1015 LET B=B+1: GO SUB 8300: PRI
NT B'''B$(B,5 TO )''C$(B): LPRIN
T B$(B,5 TO )''C$(B)'''': GO SUB
 8000
1040 LET BA=1: GO TO 8500
1100 GO SUB 8100: IF X$<>B$(B, T
O 4) THEN GO TO 8200
1120 LET BA=0: PRINT FLASH 1;"WE
LL DONE!"''': GO TO 1010
2000 BORDER 2: IF RA=1 THEN GO T
O 2100
2010 IF R=6 THEN GO TO 7000
2015 LET R=R+1: GO SUB 8300: PRI
NT R'''R$(R,5 TO )''S$(R): LPRIN
T R$(R,5 TO )''S$(R)'''': GO SUB
 8000
2040 LET RA=1: GO TO 8500
2100 GO SUB 8100: IF X$<>R$(R, T
O 4) THEN GO TO 8200
2120 LET RA=0: PRINT FLASH 1;"WE
LL DONE!"''': GO TO 2010
3000 BORDER 3: IF MA=1 THEN GO T
O 3100
3010 IF M=6 THEN GO TO 7000
3015 LET M=M+1: GO SUB 8300: PRI
NT M'''M$(M,5 TO )''N$(M): LPRIN
T M$(M,5 TO )''N$(M)'''': GO SUB
 8000
3040 LET MA=1: GO TO 8500
3100 GO SUB 8100: IF X$<>M$(M, T
O 4) THEN GO TO 8200
3120 LET MA=0: PRINT FLASH 1;"WE
LL DONE!"''': GO TO 3010
4000 BORDER 4: IF GA=1 THEN GO T
O 4100
4010 IF G=6 THEN GO TO 7000
4015 LET G=G+1: GO SUB 8300: PRI
NT G'''G$(G,5 TO )''H$(G): LPRIN
T G$(G,5 TO )''H$(G)'''': GO SUB
 8000

4040 LET GA=1: GO TO 8500
4100 GO SUB 8100: IF X$<>G$(G, T
O 4) THEN GO TO 8200
4120 LET GA=0: PRINT FLASH 1;"WE
LL DONE!"''': GO TO 4010
6000 BORDER 6: IF YA=1 THEN GO T
O 6100
6010 IF Y=6 THEN GO TO 7000
6015 LET Y=Y+1: GO SUB 8300: PRI
NT Y'''Y$(Y,5 TO )''Z$(Y): LPRIN
T Y$(Y,5 TO )''Z$(Y)'''': GO SUB
 8000
6040 LET YA=1: GO TO 8500
6100 GO SUB 8100: IF X$<>Y$(Y, T
O 4) THEN GO TO 8200
6120 LET YA=0: PRINT FLASH 1;"WE
LL DONE!"''': GO TO 6010
7000 PRINT AT 10,10; FLASH 1;"YO
U'VE WON!": PAUSE 500: CLS : GO
TO 100
8000 PRINT ''"REMOVE CLUE FROM P
RINTER"'''"NOW PRESS 0,THEN GO AN
D FIND THEANSWER": PAUSE 0: RETU
RN
8010 PAUSE 0: RETURN
8100 PRINT "TYPE IN YOUR ANSWER
THEN PRESS  THE ENTER KEY"'': IN
PUT X$: RETURN
8200 PRINT "THAT IS NOT THE RIGH
T ANSWER"'''"TRY THAT CLUE AGAIN
"'''': PAUSE 500: GO TO 8500
8300 PRINT "HERE IS CLUE NUMBER
";: RETURN
8500 BORDER 7: CLS : RETURN
9000 PRINT "READY TO LOAD DATA F
ILES"'''"PLAY DATA TAPE": LOAD ""
 DATA b$(): LOAD "" DATA c$(): L
OAD "" DATA r$(): LOAD "" DATA s
$(): LOAD "" DATA m$(): LOAD ""
DATA n$(): LOAD "" DATA g$(): LO
AD "" DATA h$(): LOAD "" DATA y$
(): LOAD "" DATA z$(): CLS : GO
TO 10
```

The listing for the program, Trailgame. The program will provide prompts on how to LOAD the data you should have already stored on tape in Traildata.



Shooter

Target in on this program for your ZX81 from nine year old John Wilson of Oldham.



Here is a program for the 16K ZX81 which combines machine code with BASIC to form a simple, but fun to play, game.

In this listing you will first need to enter the machine code using a machine code loader program such as the one included in this article. You will need 16K of memory because the machine code looks for 118, the Newline code, which means that unless RAMtop is more than 3.5K the machine code will not allow you to fire at the target.

To enter the machine code, first enter the following program:

```
1 REM ............
2 POKE 16510,0
3 FOR N=0 TO 11
4 INPUT I
5 POKE (16514+N),I
6 NEXT I
```

Now, RUN the program and input the following machine code (the commas separating the numbers represent you pressing Newline):

42,14,64,126,254,118,200,
54,22,35,24,247,

Now, remove all the lines except line 0, and type in the main body of the program shown below.

On target

Once you have typed in the whole program, type RUN and you are ready to start the game. On the right of the screen, the target will appear and on the left a column of arrows will be seen. When the arrow is in line with the target, press the 'F' key to fire.

You get ten goes to hit the target, after which you will be given your score.

```
  0 REM E:RND7⁄ RUN
  4 LET S=0
  5 FOR G=1 TO 10
  6 LET L=0
  7 CLS
  6 LET A=INT (RND*15+5)
 10 PRINT AT A,31;"▒"
 11 FOR N=0 TO 25
 12 NEXT N
 20 FOR N=1 TO 21
 30 PRINT AT N,0;">";
 40 IF INKEY$<>"" THEN LET L=US
R 16514
 50 IF L<>0 THEN GOTO 65
 60 NEXT N
 65 IF N=A THEN LET S=S+1
 70 NEXT G
 75 CLS
 80 PRINT "SCORE=";S;" OUT OF 1
0"
 90 PRINT AT 10,0;"PLAY AGAIN
(Y/N)?"
 100 IF INKEY$="Y" THEN GOTO 4
 110 IF INKEY$="" THEN GOTO 100
```

```
>
>
>
>
>
>
>
>
>
>
>                                ▒
>
>-------------------------------
SCORE=3 OUT OF 10
```

A screen illustration from the program, Shooter.

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AMAZING 3D MAZES Wander through the giant 18x18x18 mazes collecting treasures, you know where they are, but how do you get to them? Extra points are awarded for finding the shortest routes. Don't get too frustrated by apparent dead ends.

3D NOUGHTS & CROSSES Played inside a 4x4x4 cube, this is a game for the intellectual. Great graphics. It plays a mean game and wins about nine out of every ten games it plays.

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THE VAULT A high security vault in Oxford. (The game can be changed to centre around your own home town) has ten doors, each with its own five figure combination. The combination of the nine inner doors are known, but only the manager knows the combination of the outer door. Unfortunately the manager has got himself locked in the Vault. It is your job to get him out before all the Oxygen is used up. The computer will give you metaphorical clues to how near you are getting. The time switches which change the combination every so often can prove a problem. This is a case which really puts your powers of logic to the test.

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JACKPOT — for the 48K Spectrum **only £4.95**
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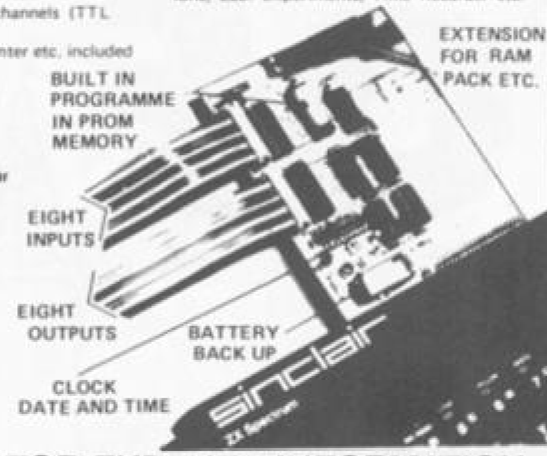
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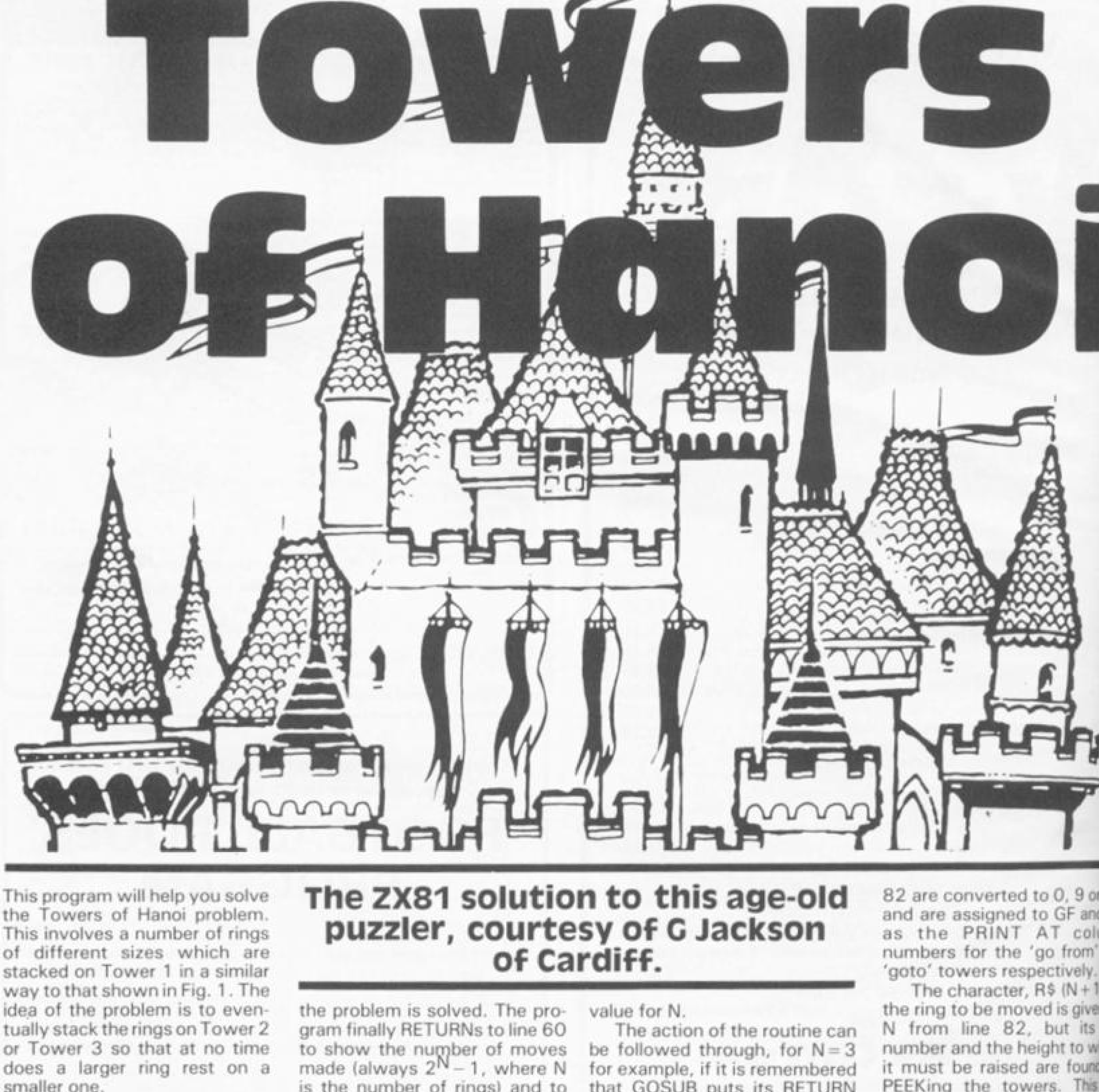
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Towers of Hanoi



The ZX81 solution to this age-old puzzler, courtesy of G Jackson of Cardiff.

This program will help you solve the Towers of Hanoi problem. This involves a number of rings of different sizes which are stacked on Tower 1 in a similar way to that shown in Fig. 1. The idea of the problem is to eventually stack the rings on Tower 2 or Tower 3 so that at no time does a larger ring rest on a smaller one.

A bit steep?

The driving force of the program is the recursive subroutine (one which calls itself) at lines 50 to 104. The program enters the subroutine with N (the number of rings in play) and breaks out at line 82 with P (the tower number — 1, 2 or 3) from which the ring is to move, Q (the number of the 'goto' tower) and N (one less than the number of the moving ring — ring 1 being the smallest). After display of the move, the routine is re-entered at line 84 for the next instruction and then circulates between lines 70 to 104 until the problem is solved. The program finally RETURNs to line 60 to show the number of moves made (always $2^N - 1$, where N is the number of rings) and to wait for key 'P' at line 64.

The recursive subroutine can be modified to run on its own. First, you should add the following line:

```
49 INPUT N
```

where N represents the number of rings. Then, replace lines 60 to 68 with:

```
60 STOP
```

Finally, replace lines 82 to 84 with the following line:

```
82 PRINT "RING";N+1;" FROM TOWER";P;" TO TOWER"; Q
```

Then, RUN 49 and enter your value for N.

The action of the routine can be followed through, for N=3 for example, if it is remembered that GOSUB puts its RETURN address (the following line) onto the GOSUB stack and each RETURN removes an address (last in — first out) and goes to it.

Start here . . .

For newcomers to the ZX81, the following notes may prove of interest.

Lines 40 to 46 produce a number of nine character rings, all PRINTed at column zero; their middle characters form the centre of Tower 1 at column four. The tops of the towers (usually invisible!) are all on screen line five.

At lines 108 to 124, the P and Q values (1, 2 or 3) from line 82 are converted to 0, 9 or 18 and are assigned to GF and GT as the PRINT AT column numbers for the 'go from' and 'goto' towers respectively.

The character, R$ (N+1), of the ring to be moved is given by N from line 82, but its line number and the height to which it must be raised are found by PEEKing the towers. This requires the display file reference address, D, which is the centre top of Tower 1. (Try adding a line 49 POKE D,23.) The D file addresses of the tops of Towers 2 and 3 are therefore D+9 and D+18, so a ring at three lines below the top of Tower 2 will have its centre at address D+9 +99 and will be found by PEEK (D+T), where T has the value of 108. In that case, the subroutine at lines 166 to 174 will RETURN to lines 114 or 124 with TT=9 and T=108 and assign value 8 to the PRINT AT line number variable X or Y. The difference between eight and three is explained by the tower tops being on screen line five.

The 'other' tower need not be PEEKed; the line number of its upper ring, Z, can be calculated because tha total of lines from the tower tops to the upper rings on all three towers is always twice the number of rings in play. Therefore, X − 5 + Y − 5 + Z − 5 = 2 × N1 (check out lines 34 and 128).

High times

It will be seen that X, Y and Z are inverse measures of the heights of the piles of rings on the 'go from', 'goto' and other tower respectively.

ABS(GF − GT) = 18 means that the 'go from' and 'goto' towers are 18 columns apart, so that the other tower is between them. If the height of its pile is greater than that of the GOTO tower, ie Z is less than Y, then the lift (if any) of the moving ring must be determined by Z and not Y — hence lines 134 to 136.

Programs with subroutines may suffer from lack of memory if they are frequently interrupted before all the GOSUBs have returned; useless return addresses accumulate in the GOSUB stack, causing it to go down in memory which may be required by the program itself. The effect of this is perpetuated when the program is SAVEd.

In this program, the stack can be cleared in the following way. First add the following line:

```
59 RUN 81
```

Then, add the following two lines:

```
61 PRINT AT 14,0;PEEK
   16386 + 256 * PEEK
   16387
81 PRINT AT 14,0;PEEK
   16386 + 256 * PEEK
   16387
```

Finally, change line 82 to read:

```
82 RETURN
```

Repeat the command, RETURN, until the error report shows T/82. Lines 61 and 81 are optional — they show the changes of the addresses of the GOSUB stack (it is 32764 when cleared). Don't forget to remove line 59 and restore line 82 before trying the game again though!

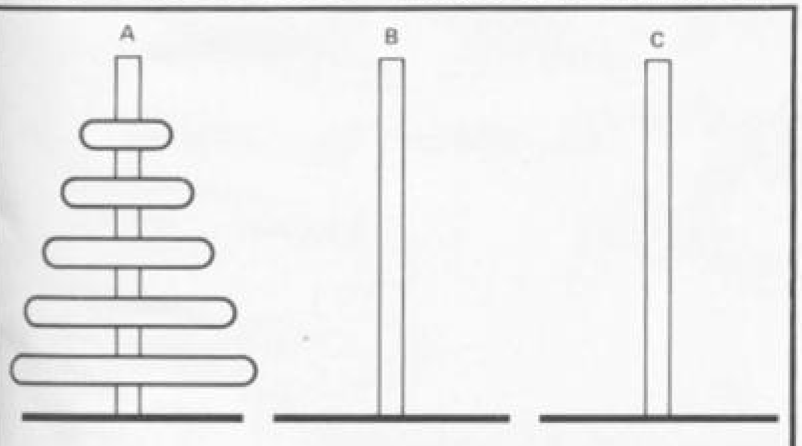


Fig. 1. You must move all the rings from Tower A via Tower B to Tower C in such a way that a larger ring never rests on a smaller ring.

```
  2 PRINT "TOWERS OF HANOI"
  4 DIM R$(9,9)
  6 LET R$(1)="    █    "
  8 LET R$(2)="   ██    "
 10 LET R$(3)="   ███   "
 12 LET R$(4)="  ████   "
 14 LET R$(5)="  █████  "
 16 LET R$(6)=" ██████  "
 18 LET R$(7)=" ███████ "
 20 LET R$(8)="████████ "
 22 LET R$(9)="         "
 24 LET M=0
 26 LET D=170+PEEK 16396+256*PE
EK 16397
 28 PRINT "HOW MANY RINGS? (2 T
O 8)"
 30 IF INKEY$<"2" OR INKEY$>"8"
THEN GOTO 30
 32 LET N=VAL INKEY$
 34 LET N1=N
 36 PRINT AT 1,0;R$(9)+R$(9)+R$
(9)
 38 REM DRAW TOWERS
        ===========
 40 PRINT AT 5,0;
 42 FOR R=1 TO N
 44 PRINT R$(R)
 46 NEXT R
 48 PRINT "▒▒▒▒▒▒▒▒▒1▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒2▒▒▒▒▒▒▒▒
▒▒▒3▒▒▒▒▒"
 50 REM "MOVE A RING" ROUTINE
        =====================
 52 LET P=1
 54 LET Q=2
 56 LET R=3
 58 GOSUB 70
 60 PRINT AT 15,0;"OK IN ";M;"
MOVES"
 62 PRINT AT 17,0;"PRESS""P""TO
 GO AGAIN"
 64 IF INKEY$<>"P" THEN GOTO 64
 66 CLS
 68 RUN
 70 IF NOT N THEN RETURN
 72 LET N=N-1
 74 LET Y=Q
 76 LET Q=R
 78 LET R=Y
 80 GOSUB 70
 82 GOTO 108
 84 LET M=M+1
 86 LET Y=P
 88 LET P=R
 90 LET R=Q
 92 LET Q=Y
 94 GOSUB 70
 96 LET Y=P
 98 LET P=Q
100 LET Q=Y
102 LET N=N+1
104 RETURN
106 REM "GO FROM" TOWER
        ===============
108 LET T=P
110 GOSUB 166
112 LET GF=TT
114 LET X=(T-TT)/33+5
116 REM "GO TO" TOWER
        =============
118 LET T=Q
120 GOSUB 166
122 LET GT=TT
124 LET Y=(T-TT)/33+5
126 REM "OTHER" TOWER
        =============
128 LET Z=2*N1-X-Y+15
130 REM DECIDE LIFT
        ===========
132 LET Y1=Y
134 IF ABS (GF-GT)=18 AND Z<Y T
HEN LET Y=Z
136 IF Y>X THEN LET Y=X+1
138 REM LIFT RING
        =========
140 FOR L=X TO Y STEP -1
142 PRINT AT L,GF;R$(9);AT L-1,
GF;R$(N+1)
144 NEXT L
146 REM MOVE TOWER TO TOWER
        ===================
148 FOR C=GF TO GT STEP 2*SGN (
GT-GF)
150 PRINT AT L,C;R$(N+1);AT L,C
;R$(9)
152 NEXT C
154 REM DROP RING
        =========
156 FOR L=L TO Y1-1
158 PRINT AT L-1,GT;R$(9);AT L,
GT;R$(N+1)
160 NEXT L
162 GOTO 84
164 REM FIND TOWER TOP AND TOP
RING    ======================
====
166 LET T=9*T-9
168 LET TT=T
170 IF PEEK (D+T) THEN RETURN
172 LET T=T+33
174 GOTO 170
```

Statistical analysis

Check out your vital statistics on your ZX Spectrum with this great package from Greg Turnbull of Sunderland.



This program, here presented for the 48K Spectrum (but with notes that follow for the program to be converted for the 16K model) provides a thorough grounding in many of the statistical tests you may wish to use when analysing quantities of data.

Amongst the different options of analysis you will have at your fingertips are standard deviation, the coefficient of variables, the standard error of mean, the F-test, the mode, regression analysis, the correlation coefficient, a sample T-test and significance testing. There is also the option to create a graph of your analysis and COPY the screen at various times throughout your work without having to break into the program.

Also included in the program is a bar chart routine. This is a complex routine using minimum and maximum values to give a range, sort data into groups and print the resultant chart on the screen.

Points to note

Any page can be COPYed by pressing the 'c' key. However, long data lists will have to be converted prior to LPRINT.

Please note that the sorting routine is in BASIC and thus may take up to 15 minutes to sort out over 100 data pairs. Remember, patience is a virtue!

This program does not have any mathematical features unique to the Spectrum, and so could easily be converted to run on most other home computers.

All you would have to note would be the POKE values, various BEEPs and colours used throughout.

The listing as it stands occupies around 22.4K of memory. However, if a note of all the instructions is made then these can be left out. Also, all the non-functioning lines can be removed along with the REM statements. You could also make use of multiple lines rather than the single statement lines I have used in some places.

In this manner, the program can be drastically reduced so that it will easily RUN on the 16K Spectrum without altering any of the program's operation.

Program description

Here follows a brief breakdown of the program's operation:

Lines 1-35	Introduction to the program and the setting up of the screen.
Lines 40-190	Read the graphics, offer a choice of instructions, create the title, input data pairs number (DIMensions two sets of arrays), input x and y data, and print out the data.
Lines 200-595	Offer you the choice of altering any of the x and y data of any row, and then re-prints the new data.
Lines 600-6030	Data for the graphics.
Lines 700-710	GOSUB 7000 to calculate all statistical values.
Lines 720-850	Provide a menu of choices — you can then choose which values are to be displayed or COPYd.
Lines 900-995	Descriptive statistics — this area provides you with the mean, standard deviation, coefficient of variables, standard error of means and the F-test.
Lines 1000-1090	PRINT/COPY data.
Lines 1100-1195	Sort data into descending order, and sorts it into B() and C() arrays. PRINTS ranked order.
Lines 1200-1290	Minimum, maximum and medians of data.
Lines 1300-1390	Statistical analysis — regression (b and c).
Lines 1400-1470	Correlation coefficient (r)
Lines 1500-1580	T-test and significance testing.
Lines 1600-1800	Draw a graph, axes names and values. Print data on graphs, checks and then draws a linear regression line through the data.
Lines 2000-3650	The bar chart routine, complete with instructions.
Lines 6000-6080	This routine asks you if you want to exit or run through the program again.
Lines 7000-7200	Calculate all the statistical values before the main routines — calculates means, CV, SD, SEM, F, t, DF, r, b and c.
Lines 8000-8730	Instructions on the use of all statistical tests and the means of the values.

```
 10 REM STATISTICS PROGRAM.
 11
 12 REM ***********************
 13 REM
 14 REM    STATISTICS PROGRAM
 15 REM    FOR 48K ZX SPECTRUM
 16 REM      GREG TUNBULL 1983
 17 REM    FOR M.Sc. PROJECT.
 18 REM
 19 REM ***********************
 20
 21 BEEP .9,28: PAPER 7: BORDER
7: CLS : PRINT INK 2;"
```



```
 24
 25 PAUSE 200: CLS
 30 BEEP .8,30: PRINT INK 1;"WO
ULD YOU LIKE INSTRUCTIONS?     (y
/n):": INPUT Z$
 40 IF Z$="y" THEN CLS : GO TO
8000
 50 IF Z$="n" THEN GO TO 70
 60 GO TO 30
 70 REM DATA INPUT, STORAGE, &
PRINTING & READ GRAPHICS.
 75 POKE 23609,35: PAPER 6: INK
 1: BORDER 6: CLS
 80 FOR f=0 TO 2: FOR g=0 TO 7:
 READ a: POKE USR CHR$ (144+f)+g
,a: NEXT g: NEXT f
 90 BEEP .7,25: PRINT INK 1;"ST
ATISTICAL ANALYSIS OF DATA BY GR
EG TURNBULL 1983."; OVER 1;AT 0,
0;"________________________________
__"; OVER 1;AT 1,0;"______________
__________
 100 PRINT "TYPE IN YOUR TOTAL N
UMBER OF      DATA PAIRS (n):": IN
PUT r: PRINT "n=";r'': LET A=r
 120 PRINT INK 1;"TYPE IN YOUR x
 AND y VALUES       (ENTER EACH ON
E):"''
 130 PRINT INK 3;"NOTE: IF YOU M
AKE A MISTAKE        WRITE IT DOWN
AND YOU WILL         BE ABLE TO ALT
ER IT LATER."
 140 DIM X(A): DIM Y(A): DIM B(A
): DIM C(A)
 150 PRINT : FOR n=1 TO A
 160 INPUT x: LET X(n)=x: LET B(
n)=x
 170 INPUT y: LET Y(n)=y: LET C(
n)=y
 180 PRINT INK 1;"n:";n;"    ";"x.
";X(n),"y:";Y(n)
 190 NEXT n: PRINT
 200 REM CHOICE OF ALTERING DATA.
 210 BEEP .8,30: PRINT INK 2;"WO
ULD YOU LIKE TO ALTER          AN
Y DATA? (y/n):": INPUT Q$: CLS
 220 IF Q$="y" THEN GO TO 250
 230 IF Q$="n" THEN GO TO 700
 240 GO TO 210
 250 PRINT "WOULD YOU LIKE TO CH
ANGE          x OR y VALUES? (x/y)
:": INPUT V$: CLS
 260 IF V$="y" THEN GO TO 410
 270 IF V$="x" THEN GO TO 290
 280 GO TO 250
 290 BEEP .8,30: PRINT INK 1;"CH
ANGE AN x VALUE:"; OVER 1;AT 0,0
;"
 300 PRINT "INPUT THE DATA ROW N
UMBER          FOR THE CHANGE (n):"
: INPUT N: CLS
 305 IF N>A THEN GO TO 300
 310 PRINT "INPUT THE x VALUE YO
U WANT         FOR THIS ROW (x):":
INPUT W: CLS
 320 LET X(N)=W: LET B(N)=W
 330 PRINT "DO YOU WANT TO ALTER
 ANY MORE     x VALUES? (y/n):": I
NPUT Q$: CLS
 340 IF Q$="y" THEN GO TO 290
 350 IF Q$="n" THEN GO TO 370
 360 GO TO 330
```

```
 370 PRINT "DO YOU WANT TO ALTER
ANY          y VALUES? (y/n):": I
NPUT Q$: CLS
 380 IF Q$="y" THEN GO TO 410
 390 IF Q$="n" THEN GO TO 530
 400 GO TO 370
 410 BEEP .8,30: PRINT INK 1;"CH
ANGE A y VALUE:"; OVER 1;AT 0,0;
"                ''"
 420 PRINT "INPUT THE DATA ROW N
UMBER          FOR THE CHANGE (n):"
: INPUT N: CLS
 425 IF N>A THEN GO TO 420
 430 PRINT "INPUT THE y VALUE YO
U WANT         FOR THIS ROW (y):":
INPUT V: CLS
 440 LET Y(N)=V: LET C(N)=V
 450 PRINT "DO YOU WANT TO ALTER
ANY MORE       y VALUES? (y/n):": I
NPUT Q$: CLS
 460 IF Q$="y" THEN GO TO 410
 470 IF Q$="n" THEN GO TO 490
 480 GO TO 450
 490 PRINT "DO YOU WANT TO ALTER
ANY            x VALUES? (y/n):": I
NPUT Q$: CLS
 500 IF Q$="y" THEN GO TO 290
 510 IF Q$="n" THEN GO TO 530
 520 GO TO 490
 530 PRINT INK 3;"NEW DATA VALUE
S:"; OVER 1;AT 0,0;"_____________
____"
 540 FOR n=1 TO A
 550 PRINT "n:";n;"   ";"x:";X(n)
,"y:";Y(n)
 560 NEXT n
 570 PRINT : PRINT INK 2;"WOULD
YOU LIKE TO ALTER            ANY FU
RTHER DATA? (y/n):": INPUT Q$: C
LS
 580 IF Q$="y" THEN GO TO 250
 590 IF Q$="n" THEN GO TO 700
 595 GO TO 570
 600 REM DATA FOR GRAPHICS.
 610 DATA 0,126,66,32,24,32,66,1
26
 620 DATA 255,0,195,102,60,60,10
2,195
 630 DATA 255,0,195,102,60,24,48
,224
 650 REM COPY DATA TO PRINTER.
 660 INPUT "PRESS ENTER TO CONTI
NUE:";W$
 670 IF W$="c" THEN COPY : CLS :
 RETURN
 680 IF W$="" THEN CLS : RETURN
 690 GO TO 650
 700 PRINT PAPER 1; INK 6; FLASH
 1;"PLEASE WAIT."'': PRINT PAPER
 6; INK 1; FLASH 0;"THE COMPUTER
 IS CALCULATING         THE STATISTI
CAL VALUES."''
 710 GO SUB 7000: CLS
 720 REM MENU OF CHOICES.
 730 CLS : BEEP .8,30: PRINT INK
 1;"WHICH TYPE OF ANALYSIS
    WOULD YOU LIKE?"''
 740 PRINT INK 2;"A) DESCRIPTIVE
 STATISTICS:"; OVER 1;AT 3,3;"
                   "'': PRINT I
NK 1;"TYPE IN '1' FOR MEAN,SD,CV
(%),  SEM & F-TEST:": PRINT "TYP
E IN '2' TO PRINT THE DATA": PRI
NT "TYPE IN '3' FOR MIN,MAX & ME
DIAN"''
 750 PRINT INK 2;"B) STATISTICAL
 ANALYSIS:"; OVER 1;AT 10,3;"
                   "'': PRINT INK
1;"TYPE IN '4' FOR REGRESSION AN
D  CORRELATION": PRINT "TYPE IN
'5' FOR 2-SAMPLE t-TEST"''
 760 PRINT INK 2;"C) GRAPHS:"; O
VER 1;AT 16,3;"          "'': PRINT
INK 1;"TYPE IN '6' FOR A LINE GR
APH": PRINT "TYPE IN '7' FOR A B
AR CHART"'': PRINT INK 3;"TYPE I
N '0' TO EXIT:"
 770 INPUT W$: IF W$="" THEN GO
TO 720
 780 LET W=VAL W$: CLS
 790 IF W=0 THEN GO TO 6000
 800 IF W>0 AND W<4 THEN GO TO 8
00+W*100
 810 IF W>4 AND W<7 THEN GO TO 1
000+W*100
 820 IF W=4 THEN GO TO 1300
 830 IF W=7 THEN GO TO 2000
 840 IF W>7 THEN GO TO 720
 900 REM START OF DESCRIPTIVE
STATISTICS.
 905
 910 REM MEANS, SD, CV(%), SEM &
F-TEST.
 915 BEEP .8,30: PRINT INK 3;"DE
SCRIPTIVE STATISTICS:"; OVER 1;A
T 0,0;"______________________''"
 920 LET s3=INT (s3*10↑5+.5)/(10
↑5): LET s4=INT (s4*10↑5+.5)/(10
↑5)
 930 LET v1=INT (v1*10↑3+.5)/(10
↑3): LET v2=INT (v2*10↑3+.5)/(10
↑3)
 940 LET s5=INT (s5*10↑5+.5)/(10
↑5): LET s6=INT (s6*10↑5+.5)/(10
↑5)
 950 LET h1=s3↑2: LET h2=s4↑2
 955 IF h1>h2 OR h1=h2 THEN LET
h3=h1/h2
 960 IF h2>h1 THEN LET h3=h2/h1
 965 LET h3=INT (h3*10↑4+.5)/(10
↑4): LET h4=A-1
 970 PRINT "N=";A,"","(B,C)=";"(
";p;",";q;")": PRINT "S.D of x="
;s3: PRINT "CV(%) of x=";v1: PRI
NT "S.E.M for x=";s5''
 975 PRINT "SD of y=";s4: PRINT
"CV(%) of y=";v2: PRINT "S.E.M f
or y=";s6''
 980 PRINT INK 3;"F-TEST:"; OVER
 1;AT 12,0;"__________"'': PRINT INK
 1;"A TEST TO COMPARE THE
    PRECISION OF x WITH THAT OF
y.": PRINT "THE F VALUE=";h3: PR
INT "FOR DF1 & DF2 OF:";h4: PRIN
T "THIS VALUE CAN BE LOOKED UP I
N  F-TABLES TO FIND A PROBABILIT
Y  (P) VALUE FOR SIGNIFICANCE
   TESTING."
 990 GO SUB 650: GO TO 720
1000 REM PRINT DATA.
1010 BEEP .8,30: PRINT INK 2;"DA
TA:"; OVER 1;AT 0,0;"     ''"
1020 IF A<21 THEN GO TO 1060
1030 LPRINT "DATA."; OVER 1;AT 0
,0;"      "'': FOR n=1 TO A
1040 LPRINT "n:";n;"   ";"x:";X(n
),"y:";Y(n)
1050 NEXT n: GO TO 1090
1060 FOR n=1 TO A
1070 PRINT "n:";n;"   ";"x:";X(n)
,"y:";Y(n)
1080 NEXT n
1090 PRINT : GO SUB 650: GO TO 7
20
1100 REM DATA SORTING INTO DESCE
NDING ORDER & PRINT RANKED DATA.
1110 PRINT PAPER 1; INK 7; FLASH
 1;"PLEASE WAIT."'': PRINT PAPER
 6; INK 1; FLASH 0;"THE COMPUTER
 IS RANKING THE DATA"
1111 REM SORT X VALUES.
1112 LET mm=A
1113 LET mm=INT (mm/2)
1114 IF mm=0 THEN GO TO 1130
1115 LET kk=A-mm
1116 LET jj=1
1117 LET ii=jj
1118 LET ll=ii+mm
```

```
1119 IF B(ii)>=B(ll) THEN GO TO 1124
1120 LET tt=B(ll): LET B(ll)=B(ii): LET B(ii)=tt
1121 LET ii=ii-mm
1122 IF ii<1 THEN GO TO 1124
1123 IF NOT ii<1 THEN GO TO 1118
1124 LET jj=jj+1
1125 IF jj>kk THEN GO TO 1113
1126 GO TO 1117
1130 REM SORT y VALUES.
1131 LET mm=A
1132 LET mm=INT (mm/2)
1133 IF mm=0 THEN GO TO 1160
1134 LET kk=A-mm
1135 LET jj=1
1136 LET ii=jj
1137 LET ll=ii+mm
1138 IF C(ii)>=C(ll) THEN GO TO 1143
1139 LET tt=C(ll): LET C(ll)=C(ii): LET C(ii)=tt
1140 LET ii=ii-mm
1141 IF ii<1 THEN GO TO 1143
1142 IF NOT ii<1 THEN GO TO 1137
1143 LET jj=jj+1
1144 IF jj>kk THEN GO TO 1132
1145 GO TO 1136
1150 REM PRINT SORTED DATA.
1160 CLS : BEEP .8,30: PRINT INK 3;"RANKED DATA:"; OVER 1;AT 0,0;"____________"''
1165 FOR l=1 TO A
1170 PRINT "n:";l;"   ";"x:";B(l),"y:";C(l)
1180 NEXT l
1190 PRINT : GO SUB 650
1200 REM MIN, MAX AND MEDIANS.
1205 PRINT INK 3;"MIN, MAX, MEDIANS:"; OVER 1;AT 0,0;"__________________"''
1210 LET s=A/2: IF s=INT s THEN GO TO 1230
1220 LET M1=B(s): LET M2=C(s): GO TO 1240
1230 LET w=A/2: LET v=A/2+1: LET M1=(B(w)+B(v))/2: LET M2=(C(w)+C(v))/2
1240 PRINT "MEDIAN OF x=";M1: PRINT "MINIMUM VALUE OF x IS ";B(A): PRINT "MAXIMUM VALUE OF x IS ";B(1)''
1250 PRINT "MEDIAN OF y=";M2: PRINT "MINIMUM VALUE OF y IS ";C(A): PRINT "MAXIMUM VALUE OF y IS ";C(1)''
1260 LET M1=INT (M1*10+.5)/10: IF M1=INT (p*10+.5)/10 OR M1+.1=INT (p*10+.5)/10 OR M1-.1=INT (p*10+.5)/10 THEN PRINT "median of x approx' equal to   mean of x indicating normally   distributed x data."''
1270 LET M2=INT (M2*10+.5)/10: IF M2=INT (q*10+.5)/10 OR M2+.1=INT (q*10+.5)/10 OR M2-.1=INT (q*10+.5)/10 THEN PRINT "median of y approx' equal to   mean of y indicating normally   distributed y data."''
1280 GO SUB 650: GO TO 720
1300 REM START OF STATISTICAL ANALYSIS.
1305
1310 REM REGRESSION AND CORRELATION.
1320 BEEP .8,30: PRINT INK 3;"REGRESSION AND CORRELATION:"; OVER 1;AT 0,0;"___________________________"''
1330 LET E=INT (E*10↑5+.5)/(10↑5): LET D=INT (D*10↑5+.5)/(10↑5): LET U=INT (U*10↑5+.5)/(10↑5)
1340 PRINT "Ax=";t1,"Ax*x=";t3,"Ay=";t2,"Ay*y=";t4,"Ax*y=";t5
1350 PRINT "n=";A,"","(B,C)=";"(";p;",";q;")"'': PRINT PAPER 1; INK 6;"For y=b*x+c"'': PRINT "b=";D,"","c=";E'': PRINT INK 3;"COR. COEFF', r=";U''
1360 IF D>.75 AND U>.75 THEN PRINT "b and r are >.75 indicating a    strong positive linear    correlation between x and y."''
1370 IF D<-.75 AND U<-.75 THEN PRINT "b and r are <-.75 indicating a  strong negative linear   correlation between x and y."''
1375 IF D<.75 AND U>.75 THEN PRINT "correlation coefficient (r)<.75 indicating a strong positive    relationship between x and y."
1380 IF U=0 THEN PRINT "r=0 this indicates that x and y are totally uncorrelated."
1390 GO SUB 650: GO TO 720
1500 REM t-TEST AND DF.
1510 BEEP .8,30: PRINT INK 3;"2-SAMPLE t-TEST:"; OVER 1;AT 0,0;"________________"''
1515 LET T=INT (T*10↑5+.5)/(10↑5)
1520 PRINT PAPER 4; INK 1;"For DF=",u2''
1530 PRINT INK 2;"THE VALUE OF t=";T''
1540 PRINT INK 1;"LOOK UP YOUR t VALUE IN t-TABLESFOR THE ABOVE DF, AND FIND THE  PROBABILITY VALUE (P)           FOR SIGNIFICANCE TESTING."''
1550 GO SUB 650: GO TO 720
1600 REM START OF GRAPHICAL SECTION.
1601
1605 REM DRAW LINE GRAPH.
1610 BEEP .8,32: PRINT INK 3;"A LINE GRAPH OF x,y:"; OVER 1;AT 0,0;"____________________"
1620 PRINT INK 1;"HAVE YOU BEEN VIA 3) MEDIANS    ROUTINE? (y/n)":: INPUT I$: IF I$="n" THEN GO TO 720
1630 IF NOT I$="y" THEN CLS : GO TO 1600
1640 PRINT "TYPE IN THE NAME OF THE x-AXIS": INPUT A$
1650 PRINT "TYPE IN THE NAME OF THE y-AXIS": INPUT B$: CLS
1660 LET F=B(1): LET G=C(1)
1670 IF F>26 THEN LET F=26
1680 IF G>18 THEN LET G=18
1690 FOR O=17 TO (8*F+40): PLOT O,9: NEXT O
1700 FOR M=9 TO (8*G+22): PLOT 17,M: NEXT M
1710 PRINT AT 21,3;A$: PRINT AT 13-G,2;B$: PRINT AT 19-G,0;G: PRINT AT 21,2.5+F;F: PRINT AT 21,1;"0"
1720 FOR n=1 TO A
1730 IF X(n)>=26 OR Y(n)>=18 THEN PRINT AT 19,3;"DATA IS TOO LARGE": GO SUB 650: GO TO 720
1735 BEEP .02,30: INK 2: OVER 1: CIRCLE 8*X(n)+17,8*Y(n)+9,2
1740 NEXT n
1750 IF p>10 OR q>10 THEN PRINT AT 19,3;"MEAN VALUES ARE TOO LARGE": GO SUB 650: GO TO 720
1760 FOR z=1 TO 20: BEEP .05,50-z: NEXT z: INK 1: PLOT 17,8*E+9: DRAW p+16*p,q+16*p: PAUSE 200
1770 GO SUB 650: GO TO 720
2000 REM BAR CHART.
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```
2010 BEEP .8,30: PRINT INK 3;"BA
R CHART."; OVER 1;AT 0,0;"
____"
2020 PRINT INK 1;"HAVE YOU BEEN
VIA THE MEDIANS    ROUTINE? (y/n)
 THIS IS BECAUSE   THE MAXIMUM AN
D MINIMUM VALUES   ARE NEEDED FOR
 THE BARCHART."'': INPUT z$
2040 IF NOT z$="y" THEN GO TO 72
0
2060 PRINT INK 1;"WOULD YOU LIKE
 A BAR CHART OF     THE x OR y DAT
A?                  TYPE IN x OR y
                    OR PRESS ENTER
 TO RETURN:"'': INPUT z$: CLS
2070 IF z$="x" THEN GO TO 2095
2080 IF z$="y" THEN GO TO 2500
2085 IF z$="" THEN GO TO 720
2090 GO TO 2060
2095 PRINT FLASH 1;"PLEASE WAIT.
"'' FLASH 0;"THIS MAY TAKE SOME
TIME!"
2096 REM CALCULATE X VALUES.
2100 LET minx=B(A): LET maxx=B(1
): DIM R(15): DIM L(16): LET div
x=(maxx-minx)/15
2110 FOR B=1 TO 15: FOR n=1 TO A
2120 LET P9=0: LET R9=minx+divx
2125 IF B=15 THEN LET R9=R9+.000
001
2130 IF X(n)>=minx AND X(n)<R9 T
HEN LET P9=P9+1: LET R(B)=R(B)+P
9: LET L(B)=L(B)+P9
2140 NEXT n
2150 LET minx=minx+divx
2160 NEXT B
2165 PRINT "NEARLY FINISHED."
2170 FOR J=1 TO 15: FOR K=1 TO 1
5
2180 LET l=0: IF L(K+1)>L(K) THE
N LET l=L(K): LET L(K)=L(K+1): L
ET L(K+1)=l
2190 NEXT K: NEXT J
2200 LET highx=L(1): LET scalex=
1
2210 IF highx>18 THEN LET scalex
=scalex+1: LET highx=highx-18: G
O TO 2210
2250 GO TO 3000
2500 PRINT FLASH 1;"PLEASE WAIT.
"'' FLASH 0;"THIS MAY TAKE SOME
TIME!"
2505 REM CALCULATE Y VALUES.
2510 LET miny=C(A): LET maxy=C(1
): DIM S(15): DIM M(16): LET div
y=(maxy-miny)/15
2520 FOR B=1 TO 15: FOR n=1 TO A
2530 LET P9=0: LET R9=miny+divy
2535 IF B=15 THEN LET R9=R9+.000
001
2540 IF Y(n)>=miny AND Y(n)<R9 T
HEN LET P9=P9+1: LET S(B)=S(B)+P
9: LET M(B)=M(B)+P9
2550 NEXT n
2560 LET miny=miny+divy
2570 NEXT B
2575 PRINT "NEARLY FINISHED."
2580 FOR J=1 TO 15: FOR K=1 TO 1
5
2590 LET l=0: IF M(K+1)>M(K) THE
N LET l=M(K): LET M(K)=M(K+1): L
ET M(K+1)=l
2600 NEXT K: NEXT J
2610 LET highy=M(1): LET scaley=
1
2620 IF highy>18 THEN LET scaley
=scaley+1: LET highy=highy-18: G
O TO 2620
2630 GO TO 3500
3000 REM DRAW BAR CHART OF X.
3010 IF scalex=1 THEN GO TO 3030
3020 FOR B=1 TO 15: LET R(B)=INT
 (R(B)/scalex+.5): NEXT B
3030 BEEP .25,20: CLS : DIM J$(1
8): PRINT "INPUT THE NAME OF THE
 HORIZONTAL(x) AXIS:": INPUT I$
3040 PRINT "INPUT THE NAME OF TH
E VERTICAL  (y) AXIS:": INPUT J$
: CLS
3050 BEEP .8,30: PLOT 16,16: DRA
W 0,143: PLOT 16,16: DRAW 239,0:
 PRINT AT 0,4;"A BAR CHART OF x.
"; OVER 1;AT 0,4;"
___": PRINT AT 19,1;"0": PRINT AT
 20,2;B(A): PRINT AT 20,28;B(1):
 PRINT AT 21,6;I$: FOR z=0 TO 17
: PRINT AT z+4,0;J$(z+1): NEXT z
: PRINT AT 2,0;18*scalex
3055 LET sp=2
3060 FOR B=1 TO 15
3065 IF R(B)=0 THEN LET sp=sp+2:
 GO TO 3110
3070 FOR J=1 TO R(B)
3080 PRINT INK 2;AT 20-J,sp;"■":
 PRINT INK 2;AT 20-J,sp+1;"■"
3090 NEXT J
3100 LET sp=sp+2
3110 NEXT B
3150 GO SUB 650: CLS : GO TO 206
0
3500 REM DRAW BAR CHART OF Y.
3510 IF scaley=1 THEN GO TO 3530
3520 FOR B=1 TO 15: LET S(B)=INT
 (S(B)/scaley+.5): NEXT B
3530 BEEP .25,20: CLS : DIM K$(1
8): PRINT "INPUT THE NAME OF THE
 HORIZONTAL(x) AXIS:": INPUT I$
3540 PRINT "INPUT THE NAME OF TH
E VERTICAL  (y) AXIS:": INPUT K$
: CLS
3550 BEEP .8,30: PLOT 16,16: DRA
W 0,143: PLOT 16,16: DRAW 239,0:
 PRINT AT 0,4;"A BAR CHART OF y.
"; OVER 1;AT 0,4;"
___": PRINT AT 19,1;"0": PRINT AT
 20,2;C(A): PRINT AT 20,28;C(1):
 PRINT AT 21,6;I$: FOR z=0 TO 17
: PRINT AT z+4,0;K$(z+1): NEXT z
: PRINT AT 2,0;18*scaley
3560 LET sp=2
3570 FOR B=1 TO 15
3580 IF S(B)=0 THEN LET sp=sp+2:
 GO TO 3630
3590 FOR J=1 TO S(B)
3600 PRINT INK 2;AT 20-J,sp;"■":
 PRINT INK 2;AT 20-J,sp+1;"■"
3610 NEXT J
3620 LET sp=sp+2
3630 NEXT B
3650 GO SUB 650: CLS : GO TO 206
0
6000 REM EXIT.
6010 PRINT "ARE YOU SURE? (y/n):
": INPUT Y$: CLS
6020 IF Y$="n" THEN GO TO 720
6030 IF Y$="y" THEN GO TO 6050
6040 GO TO 6010
6050 PRINT "WOULD YOU LIKE TO RU
N          THE PROGRAM AGAIN? (
y/n):": INPUT Y$: CLS
6060 IF Y$="y" THEN RESTORE 600:
 GO TO 70
6070 IF Y$="n" THEN BEEP .9,20:
PRINT INK 2;"O.K. BYE!": STOP
6080 GO TO 6050
7000 REM CALCULATION OF SUM OF
TOTALS, MEANS, SD, CV, SEM, REG,
COR. OF X,Y.
7010 LET t1=0: LET t2=0: LET t3=
0: LET t4=0: LET t5=0: LET S1=0:
 LET S2=0
7020 FOR h=1 TO A
7030 LET t1=t1+X(h): LET t2=t2+Y
(h): LET t3=t3+X(h)↑2: LET t4=t4
+Y(h)↑2: LET t5=t5+X(h)*Y(h)
7040 NEXT h
7050 LET q=t2/A: LET q=INT (q*10
↑3+.5)/(10↑3): REM MEAN(y)
```

```
7060 LET p=t1/A: LET p=INT (p*10
↑3+.5)/(10↑3): REM MEAN(x)
7070 LET D=(t5-(t1*t2/(h-1)))/(t
3-(t1↑2/(h-1))): REM REG(b)
7080 LET U=(t5-(t1*t2/(h-1)))/SQ
R ((t3-(t1↑2/(h-1)))*(t4-(t2↑2/(
h-1)))): REM COR(r)
7090 LET E=q-D*p: REM REG(c)
7100 FOR i=1 TO A
7110 LET s1=s1+(X(i)-p)*(X(i)-p)
: LET s2=s2+(Y(i)-q)*(Y(i)-q)
7120 NEXT i
7130 LET s3=SQR (s1/(i-2)): LET
s4=SQR (s2/(i-2)): REM SD(x&y)
7140 LET v1=s3/p*100: LET v2=s4/
q*100: REM CV(x&y)
7150 LET s5=s3/SQR (i-1): LET s6
=s4/SQR (i-1): REM SEM(x&y)
7160 LET u2=2*A-2: REM DF
7170 IF q>p THEN LET T=(q-p)/SQR
 ((2/(u2*A))*(t3+t4-(t1↑2/A)-(t2
↑2/A))): GO TO 7190
7180 LET T=(p-q)/SQR ((2/(u2*A))
*(t3+t4-(t1↑2/A)-(t2↑2/A))): REM
 t-TEST
7190 RETURN
8000 REM INSTRUCTIONS
8010 BEEP .6,30: PRINT INK 2;"IN
STRUCTIONS ON STATISTICS:"; OVER
 1;AT 0,0;"______________________
__"''
8020 PRINT INK 1;"THIS PROGRAM A
LLOWS YOU TO INPUTTWO SETS OF DA
TA OF ANY LENGTH  FOR A 48K SPEC
TRUM. THE PROGRAM CAN BE MODIFIE
D TO RUN ON A 16K SPECTRUM IF AL
L NON-ESSENTIAL    LINES, REM STA
TEMENTS AND        INSTRUCTIONS A
RE LEFT OUT OF THELISTING. NOTE:
 BOTH SETS OF DATAMUST BE OF
EQUAL LENGTH, THE TOTAL NUMBER
OF DATA PAIRS       BEING ENTERED
AS n"''
8030 GO SUB 650
8060 PRINT INK 3;"THE RAW DATA:"
; OVER 1;AT 0,0;"____________":
PRINT INK 1;"THIS WILL BE STORED
 IN TWO           SEPARATE ARRAYS, ON
E FOR             PRINTING AND ANALYS
IS, THE OTHERFOR RANKING (USED I
N MEDIANS).  YOU WILL THEN BE AB
LE TO ALTER    ANY OF THE DATA THA
T MAY HAVE     BEEN ENTERED INCORR
ECTLY. THE     STATISTICAL TESTS A
RE THEN        PERFORMED AND A MEN
U OF CHOICES PRINTED."''
8070 GO SUB 650
8100 PRINT INK 3;"DESCRIPTIVE ST
ATISTICS:"; OVER 1;AT 0,0;"_____
________________"'': PRINT INK
1;"THIS GIVES YOU THE MEANS
    (AVERAGES) OF THE TWO SETS OF
    DATA. IT ALSO GIVES YOU SOME
    MEASURES OF THE DISTRIBUTION
OF VALUES ABOUT THE MEANS.": PRI
NT INK 3;"THESE ARE A) STANDARD
DEVIATION:": PRINT OVER 1;AT 7,1
3;"_______________": PRINT IN
K 1;"THIS VALUE IS BOTH POSITIVE
 (+) AND NEGATIVE (-). AT THE 95
%    CONFIDENCE LIMIT LEVEL 95.4
% OF ALL VALUES SHOULD LIE WITHI
N +2 OR -2 SD FROM THE MEAN. SO
ANY  VALUE OUTSIDE THESE LIMITS
MUST BE CONSIDERED STATISTICALLY
     DIFFERENT FROM THE MEAN OF
     NORMALLY DISTRIBUTED DATA."
8120 PRINT : GO SUB 650
8150 PRINT INK 3;"B) COEFFICIENT
 OF VARIATION (CV)"; OVER 1;AT 0
,0;"
_____"'': PRINT INK 1;"THIS IS A
PERCENTAGE (%) VALUE  OFTERN USE
D TO EXPRESS THE      PRECISION
OF THE DATA.          IT RELATES
 BOTH THE SD AND MEAN BY: CV=SD/
MEAN*100%.   A LOW CV INDICATES
GOOD  PRECISION, AND AHIGH VALUE
 INDICATES POOR       PRECISION.
"''
8160 GO SUB 650
8190 PRINT INK 3;"C) STANDARD ER
ROR OF THE MEAN    (SEM):"; OVER
1;AT 0,0;"
__________"'': PRINT INK 1;"THIS IS
 AN ESTIMATE OF HOW CLOSETHE MEA
N OF YOUR SAMPLE IS TO  THE MEA
N OF THE POPULATION FROM WHICH I
T WAS TAKEN. HENCE THIS  VALUE M
AY NOT BE RELEVANT FOR  ALL SET
S OF DATA.               THE CAL
CULATION IS SEM=SD/SQR(n)SO AS S
AMPLE SIZE INCREASES,   THE SEM
 SHOULD DECREASE AS IT  APPROAC
HES THE 'TRUE' MEAN OF  THE POP
ULATION. (WHERE SEM=0)"''
8200 GO SUB 650
8230 PRINT INK 3;"F-TEST:"; OVER
 1;AT 0,0;"_______"'': PRINT INK
1;"THIS IS A TEST SOMETIMES USED
 TOCOMPARE THE PRECISIONS OF TWO
    SETS OF DATA. THE F VALUE IS
    CALCULATED FROM THE VARIANCE
    RATIO (VARIANCE=SD SQUARED) B
Y: F=(LARGER VARIANCE)/(SMALLER
    VARIANCE). THIS VALUE IS THE
    LOOKED UP IN F-TABLES FOR TWO
 DF(DEGREES OF FREEDOM) VALUES
    (IN THIS CASE BOTH VALUES ARE
    EQUAL AND ONLY ONE IS PRINTED
). FROM THE TABLES A PROBABILITY
    VALUE (P) IS FOUND AND THIS C
AN BE USED IN ASSESSING THE
    SIGNIFICANCE (IF ANY) BETWEEN
    THE TWO PRECISIONS. SEE ALSO
THENOTES ON THE t-TEST."
8250 PRINT : GO SUB 650
8280 PRINT INK 3;"PRINT DATA:";
OVER 1;AT 0,0;"        ": PRIN
T INK 1;"THE SECOND CHOICE ON TH
E MENU    ALLOWS YOU TO LIST THE
DATA.     THIS CAN BE COPIED BY P
RESSING  'c' INSTEAD OF ENTER, S
O ANY     TIME A HARD COPY OF THE
          INSTRUCTIONS OR THE ANA
LYSIS IS REQUIRED JUST PRESS 'c'
."''
8300 GO SUB 650
8320 PRINT INK 3;"MEDIANS & DATA
 SORTING:"; OVER 1;AT 0,0;"_____
__________": PRINT INK 1;
"THE THIRD CHOICE (AND FINAL PAR
TOF DESCRIPTIVE STATISTICS) WILL
 USE A SORTING ROUTINE TO RANK
 THE SPARE ARRAY DATA INTO
 DESCENDING ORDER (THIS MAY TAKE
 SOME TIME AS IT IS IN BASIC AND
 NOT MACHINE CODE!). ONCE THE
 DATA HAS BEEN RANKED IT WILL BE
 LISTED AND THE MAXIMUM, MINIMUM
 AND MEDIAN VALUES FOR x & y WIL
LBE DISPLAYED. THE MEDIAN IS A
 VALUE WHICH DIVIDES THE NUMBER
 OF OBSERVATIONS INTO TWO EQUAL
 PARTS. IN NORMALLY DISTRIBUTED
 DATA IT WOULD BE EQUAL, OR VERY
 CLOSE TO THE MEAN VALUE. THUS
 DIFFERENCES BETWEEN THE MEAN AN
DMEDIAN SHOWS LEFT OR RIGHT SKEW
 IN THE DATA."
8340 PRINT : GO SUB 650
8370 PRINT INK 3;"THE MODE:"; OV
ER 1;AT 0,0;"________"'': PRINT
INK 1;"THIS IS THE MOST COMMONLY
          OCCURING VALUE IN ANY SET
 OF       DATA. IN THIS PROGRAM IT
CAN       EASILY BE SEEN IN THE LIS
T OF      RANKED DATA.IN NORMALLY
```

```
      DISTRIBUTED DATA THE MODE
, MEAN AND MEDIAN WOULD ALL BE
      (APPROXIMATELY) EQUAL. AN
Y LEFT OR RIGHT SKEW IN THE DATA
 WOULD MAKE THEM SIGNIFICANTLY
      DIFFERENT FROM EACH OTHER
."''
8380 GO SUB 650
8410 PRINT INK 3;"STATISTICAL AN
ALYSIS:"; OVER 1;AT 0,0;"
            "'': PRINT INK 1;"T
HESE CHOICES GIVE VARIOUS      C
ALCULATIONS ON THE DATA WHICH  W
OULD BE VERY TIME CONSUMING TO D
O MANUALLY. THEY ARE REGRESION,C
ORRELATION AND t-TEST."''
8420 GO SUB 650
8450 PRINT INK 3;"REGRESSION ANA
LYSIS:"; OVER 1;AT 0,0;"
         "'': PRINT INK 1;"THI
S IS AN ESTIMATE OF THE      ASS
OCIATION OF THE x DATA WITH  THE
 y DATA. LINEAR REGRESSION ISUSE
D, WHERE IF THE ASSOCIATION  IS
A  STRAIGHT LINE THEN IT WILLHAV
E THE FORMULAE y=b*x+c WHERE c=I
NTERCEPT ON THE y-AXIS AND   b=R
EGRESSION COEFFICIENT        (GR
ADIENT). IF THE ASSOCIATION  IS
TOTALLY LINEAR THEN b WILL BE+1
OR -1 DEPENDING ON THE SLOPE OF
THE LINE. STATISTICALLY      REG
RESSION IS USED TO DRAW A    BES
T-FIT LINE THROUGH SPREAD-OUTDAT
A."''
8460 GO SUB 650
8490 PRINT INK 1;"HERE b IS CLCU
LATED AND USED TO FIND THE VALUE
 OF c (BY c=C-b*B)THE LINE IS TH
EN DRAWN FROM c    THROUGH (B,C)
TO THE UPPER       LIMITS OF THE
DATA. THIS LINE    DRAWING METHOD
 IS THE ONE USED   ON THE PLOT A
GRAPH CHOICE.      NOTE: THE LINE
 ONLY WORKS FOR    POSITIVELY COR
RELATED DATA,      IF THE DATA IS
 NEGATIVELY        CORRELATED THE
 LINE WILL RUN OFFTHE SCREEN. TH
IS CAN BE AVOIDED IF PROGRAM LIN
ES 1750 & 1760 AREDELETED. SEE A
LSO GRAPH          INSTRUCTIONS."
''
8500 GO SUB 650
8530 PRINT INK 3;"CORRELATION CO
EFFICIENT:"; OVER 1;AT 0,0;"
                 "'': PRINT IN
K 1;"THIS IS ANOTHER EXPRESSION
OF   THE ASSOCIATION BETWEEN THE
 TWO SETS OF DATA. COMPLETE
     CORRELATION WILL GIVE AN r
VALUEOF +1 OR -1 DEPENDING ON TH
E    SLOPE OF THE LINE. IF THE D
ATA  IS TOTALLY UNCORRELATED THE
N r  WILL BE 0. CORRELATION AND
     REGRESSION ANALYSIS ARE USU
ALLY USED IN CONJUNCTION AND ARE
     OFTERN DISPLAYED ON THE GRA
PHS  OF DATA."''
8540 GO SUB 650
8570 PRINT INK 3;"2-SAMPLE t-TES
T:"; OVER 1;AT 0,0;"
____"'': PRINT INK 1;"THERE ARE M
ANY TYPES OF t-TEST   ANALYSIS. T
HE ONE USED HERE IS   FOR TWO SAM
PLES OF EQUAL LENGTH.THE TEST IS
 USED TO DETERMINE    WHETHER THE
RE IS ANY SIGNIFICANTDIFFERENCE
BETWEEN THE TWO SETS OF DATA. TH
E t VALUE IS          CALCULATED
ALONG WITH THE        DEGREES OF
FREEDOM (DF) FOR THE DATA. FROM
THESE, STUDENT'S      t-TABLES CA
N BE USED TO FIND THEPROBABILITY
 VALUE (P) FOR        SIGNIFICANC
E TESTING."''
8580 GO SUB 650
8610 PRINT INK 3;"SIGNIFICANCE T
ESTING:"; OVER 1;AT 0,0;"
         "'': PRINT INK 1;"T
HIS USES THE P VALUE (WHICH MAYB
E EXPRESSED AS A %) TO SEE IF  T
HERE IS ANY STATISTICAL        D
IFFERENCE BETWEEN THE TWO SETS O
F DATA FOR EXAMPLE P<=0.001    (
OR 0.1%) MEANS THAT THE DATA   A
RE STATISTICALLY THE SAME.     N
OTE: IF THE t VALUE EXCEEDS THET
ABULATED VALUES THEN THE       D
IFFERENCE IS SIGNIFICANT       (
ie: NOT LIKELY TO BE DUE TO    C
HANCE ALONE.)"''
8620 GO SUB 650
8650 PRINT INK 3;"THE LINE GRAPH
:"; OVER 1;AT 0,0;"
_"'': PRINT INK 1;"THIS IS LIMIT
ED BY THE SCREEN   SIZE FOR THE
SPECTRUM. IT WILL  ONLY ALLOW (x
,y)<(26,20) TO BE  PRINTED, OR M
EANS<11. IT ALSO   ASSUMES POSIT
IVE LINEAR         CORRELATION B
ETWEEN x & y WHEN  IT DRAWS A LI
NE THROUGH THE     POINTS. HOWEV
ER AS MENTIONED    THIS COULD BE
 AVOIDED IF        NECESSARY BY
THE DELETION OF THERELEVANT LINE
S. IF A GRAPH OF   HIGH DATA IS
NEEDED, YOU WOULD  HAVE TO RE-EN
TER THE VALUES     AFTER DIVISIO
N BY A SUITABLE    FACTOR TO DEC
REASE THEIR SIZE."''
8660 GO SUB 650
8690 PRINT INK 1;"THE GRAPH ROUT
INE WILL ALLOW YOUTO NAME THE TW
O AXES, AND        SPECIFY THEIR
MAXIMUM LENGTHS.   THUS THE ROUT
INE IS VERY USEFULFOR VISUALISI
NG THE ACTUAL      RELATIONSHIPS
BETWEEN TWO SETS   OF DATA.  IT C
AN BE COPIED TO    THE PRINTER BY
 PRESSING 'c'."''
8700 GO SUB 650
8710 PRINT INK 3;"BAR CHART."; O
VER 1;AT 0,0;"       "'': PRIN
T INK 1;"THIS ROUTINE ALLOWS YOU
 TO      CHOOSE A BAR CHART OF x
 OR y    VALUES. AGAIN IT IS LIM
ITED BY  THE SCREEN SIZE OF THE
SPECTRUM THE VALUES ARE SORTED I
NTO 15   DOUBLE-WIDTH COLUMNS BY
A        DIVISION FACTOR CALCULA
TED FROM THE MAXIMUM AND MINIMUM
 DATA    VALUES. THUS YOU MUST G
O THROUGHCHOICE NUMBER 3 (MEDIAN
S) BEFOREUSING THE BAR CHART. TH
E DATA ISSORTED INTO AN ARRAY AC
CORDING  TO ITS PARTICULAR VALUE
. IF THE COLUMN BECOMES TOO LARG
E (>17)  THEN THE COMPUTER WILL
SCALE    DOWN ALL THE VALUES AS
REQUIRED.THE USE OF THIS IS THAT
 IT WILL SHOW YOU IF THE DATA IS
 NORMALLYDISTRIBUTED THIS IS REQ
UIRED BY MANY STATS TESTS."
8720 GO SUB 650
8800 PRINT "PRESS r TO READ THES
E          INSTRUCTIONS AGAIN,
c TO COPY,  AND 'ENTER' TO RETUR
N TO       THE MAIN PROGRAM:":
INPUT U$
8810 IF U$="r" THEN CLS : GO TO
8000
8820 IF U$="" THEN CLS : GO TO 7
0
8830 IF U$="c" THEN COPY : CLS :
 GO TO 8700
8840 GO TO 8700
9000 REM THIS LISTING OCCUPIES
28.2 K.
```

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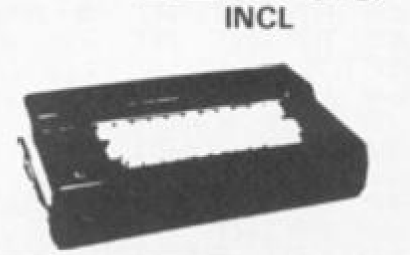
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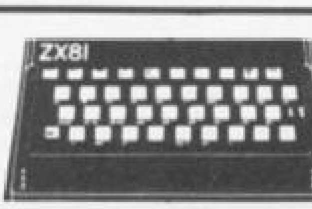
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Take part in an aerial assault course in this program written for us by Jeremy Lever of Douglas, Isle of Man.



Crazy ballooning

This is an adaptation of the popular arcade game for the ZX81. You have to guide the balloon around the course of prickly asterisks to reach the area marked 'GOAL' in the top left-hand corner of the maze.

You start at the bottom right-hand corner of the course and the controls you should use to guide your balloon are shown in Fig. 1. Obviously, the idea of the game is to try and get your balloon to the goal without it hitting the asterisks which, in case you couldn't guess, burst your bubble!

Q	W	E
A	*	D
Z	X	C

Fig. 1.

Program description

Below is a brief breakdown of the program.

You can always take a short cut through one of the two gates in the asterisk wall — but take care, this is not always the easiest route!

Lines 1-85	Initialisation.
Lines 90-185	What key has been pressed?
Lines 193-240	What has the balloon hit?
Lines 255-300	Swing routine.
Lines 400-520	The 'balloon burst' and 'high score' routines.
Lines 550-570	The goal routine.
Lines 600-620	The bounce at the start of the game.
Lines 1000-1250	The routine to set up the screen.
Lines 2000-2200	The routine containing the instructions.
Lines 3000-3320	The movement routine.

```
   1 REM *CRAZY BALLOON*
   2 LET S=0
   3 LET HS=50
   4 LET R=0
   5 LET N$="ZX81"
   7 SLOW
  10 CLS
  11 LET K=0
  12 LET X=0
  13 LET BA=3
  15 PRINT "INSTRUCTIONS (Y/N)"
  16 LET W$=INKEY$
  17 IF W$="Y" THEN GOTO 2000
  18 IF W$="N" THEN GOTO 20
  19 GOTO 16
  20 CLS
  21 LET X=0
  25 GOSUB 1000
  27 IF X=16 THEN LET O=0
  30 PRINT AT 0,0;"SCORE ";S
  35 PRINT AT 0,14;N$
  40 PRINT AT 0,25;HS
  45 PRINT AT 20,0;BA;" BALLOONS
 LEFT"
  60 LET V=16
  70 LET Y=V+1
  80 LET H=21
  85 LET Z=H
  90 PRINT AT V,H;"O"
 100 PRINT AT Y,Z;"I"
 110 LET A$=INKEY$
 111 FAST
 115 PRINT AT 0,6;S
 120 IF A$="D" THEN GOTO 3180
 130 IF A$="A" THEN GOTO 3220
 140 IF A$="W" THEN GOTO 3260
 150 IF A$="X" THEN GOTO 3300
 160 IF A$="E" THEN GOTO 3000
 170 IF A$="Q" THEN GOTO 3050
 180 IF A$="C" THEN GOTO 3100
 185 IF A$="Z" THEN GOTO 3150
 191 LET S=S-1
 192 LET S=S+1
 193 IF K=1 THEN GOTO 196
 194 PRINT AT Y,Z;
 195 GOTO 200
 196 PRINT AT V,H;
 200 LET P=PEEK (256*PEEK 16399+
PEEK 16398)
 210 IF P=23 THEN GOTO 400
 220 IF P=128 THEN GOTO 550
 230 IF P=8 THEN GOSUB 600
 231 IF P=131 THEN LET S=S+60
 232 IF P=9 THEN LET S=S+40
 233 IF K=1 THEN GOTO 239
 234 LET K=1
 235 GOTO 196
 239 LET K=0
 240 SLOW
 245 PRINT AT V,H;"O"
 250 PRINT AT Y,Z;"I"
 255 LET X=X+1
 260 IF X=5 THEN LET H=H-1
 261 IF X=5 THEN PRINT AT V,H+1;
" "
 265 IF X=10 THEN LET H=H+1
 266 IF X=10 THEN PRINT AT V,H-1
;" "
 270 IF X=15 THEN LET H=H+1
 271 IF X=15 THEN PRINT AT V,H-1
;" "
 275 IF X=20 THEN LET H=H-1
 276 IF X=20 THEN PRINT AT V,H+1
;" "
 280 IF X=25 THEN LET H=H-1
```

```
 281 IF X=25 THEN PRINT AT V,H+1
;" "
 290 IF X=30 THEN LET H=H+1
 291 IF X=30 THEN PRINT AT V,H-1
;" "
 292 IF X=35 THEN LET X=10
 300 GOTO 110
 400 PRINT AT V,H;"X"
 401 PRINT AT Y,Z;"I"
 402 LET BA=BA-1
 405 PAUSE 70
 410 CLS
 420 PRINT AT 10,11;"*B*A*N*G*"
 421 SLOW
 425 PAUSE 100
 426 IF BA<>0 THEN GOTO 20
 430 IF S>HS THEN GOTO 460
 440 PAUSE 9999
 445 LET S=0
 447 SLOW
 450 GOTO 10
 460 CLS
 470 PRINT "NAME"
 480 INPUT K$
 490 IF LEN (K$)>10 THEN GOTO 46
0
 495 LET N$=K$
 500 LET HS=S
 510 LET S=0
 520 GOTO 10
 550 LET C=INT (RND*1000)
 551 SLOW
 555 IF C<400 THEN GOTO 550
 556 LET S=S+C
 557 FOR I=1 TO 10
 558 PRINT AT 8,1;"GOAL"
 559 PRINT AT 8,1;"GOAL"
 560 NEXT I
 561 PAUSE 9999
 570 GOTO 20
 600 LET V=17
 610 LET H=21
 620 RETURN
1006 PRINT AT 1,0;"**************
**************"
1020 PRINT "**** ************
*****"
1030 PRINT "***    *******
 ****"
1040 PRINT "**         **
  *** C"
1050 PRINT "**  *          ***
   ** R"
1060 PRINT "*     **      ******
   ** A"
1070 PRINT "*▒▒▒▒▒▒******■*********
  *** Z"
1080 PRINT "*GOAL***      ******
  *** Y"
1090 PRINT "******          ****
   **  "
1100 PRINT "*****     **     *
  *** B"
1110 PRINT "***      ****
  *** A"
1120 PRINT "**      *******
   ** L"
1130 PRINT "**    *        **▒****
***** L"
1140 PRINT "**   *        *    ***
***** O"
1150 PRINT "*   **   **
▒▒▒▒▒* O"
1160 PRINT "**       ****    *
    ▒* N"
1170 PRINT "***      ***********
    ▒*"
1180 PRINT "*******************▒
▒▒▒▒▒*"
1190 PRINT "*********************
*****"
1210 FOR Q=4 TO 16
1220 PRINT AT Q,26;" "
1230 NEXT Q
1231 IF R=1 THEN GOTO 1250
1232 LET R=R+1
1235 GOTO 1000
1250 RETURN
2000 CLS
2005 PRINT AT 0,9;"CRAZY BALLOON
"
2007 PRINT AT 1,9;"-------------
"
2010 PRINT "MOVE ROUND THE COURS
E AVOIDING"
2015 PRINT
2020 PRINT "THE PRICKLY STARS- *
"
2025 PRINT
2030 PRINT "EXTRA POINTS ARE AWA
RDED FOR"
2035 PRINT
2040 PRINT "GOING THROUGH THE GA
TES- ■ + ▒"
2045 PRINT
2050 PRINT "THE OBJECT IS TO GET
 TO THE"
2055 PRINT
2060 PRINT "GOAL IN THE TOP LEFT
 HAND"
2065 PRINT
2070 PRINT "CORNER."
2075 PRINT
2077 PRINT "THE CONTROLS ARE:"
2078 PRINT
2080 PRINT AT 18,15;"QWE"
2090 PRINT AT 19,15;"A*D"
2100 PRINT AT 20,15;"ZXC"
2180 PAUSE 9999
2190 CLS
2200 GOTO 20
3000 LET V=V-1
3010 LET H=H+1
3011 LET Y=Y-1
3012 LET Z=Z+1
3015 PRINT AT V+1,H-1;" "
3020 PRINT AT Y+1,Z-1;" "
3025 GOTO 192
3050 LET V=V-1
3060 LET H=H-1
3061 LET Y=Y-1
3062 LET Z=Z-1
3065 PRINT AT V+1,H+1;" "
3070 PRINT AT Y+1,Z+1;" "
3075 GOTO 192
3100 LET V=V+1
3110 LET H=H+1
3111 LET Y=Y+1
3112 LET Z=Z+1
3115 PRINT AT V-1,H-1;" "
3120 PRINT AT Y-1,Z-1;" "
3125 GOTO 192
3150 LET V=V+1
3160 LET H=H-1
3161 LET Y=Y+1
3162 LET Z=Z-1
3165 PRINT AT V-1,H+1;" "
3170 PRINT AT Y-1,Z+1;" "
3175 GOTO 192
3180 LET H=H+1
3185 LET Z=Z+1
3190 PRINT AT V,H-1;" "
3195 PRINT AT Y,Z-1;" "
3200 GOTO 192
3220 LET H=H-1
3225 LET Z=Z-1
3230 PRINT AT V,H+1;" "
3235 PRINT AT Y,Z+1;" "
3240 GOTO 192
3260 LET V=V-1
3265 LET Y=Y-1
3270 PRINT AT V+1,H;" "
3275 PRINT AT Y+1,Z;" "
3280 GOTO 192
3300 LET V=V+1
3305 LET Y=Y+1
3310 PRINT AT V-1,H;" "
3315 PRINT AT Y-1,Z;" "
3320 GOTO 192
```

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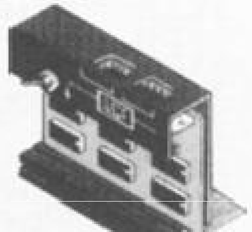
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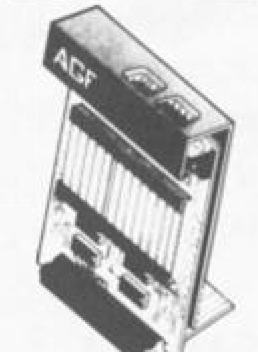
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Games galore

Tim Hartnell looks at a number of ideas which are ideal for conversion to computer games.

Many times I've discovered when trying to convert a 'traditional' (that is, non-computer) game to my computer, the program which I finally end up with plays a game with little resemblance to the original idea. I don't think that matters at all. So long as the game is fun to play, the route followed to that game is unimportant.

You may also find that just reading through the games presented here will spark an idea for a program which is totally unrelated to the outline given. This article has been designed to act as a series of 'idea-starters'. Make your own choice on whether you intend to follow the outlines, or simple use them as take-off points for your own creativity.

Checkers derivatives

You have probably seen games which could be described as 'checkers derivatives'. That is, they are games which are based on — but differ in at least one important particular from — checkers (or 'draughts' as the game is generally known in the UK). It doesn't take too much thought to realise that the eight by eight checkerboard, and the normal checker pieces and their moves can form the basis of a whole series of intelligent board games.

All you need to do is to postulate a 'what if', and then write your game from that point. Here are some examples which should explain the 'what if' idea. You're sure to be able to think of others.

— Use a board which is nine by nine, or seven by seven, with a corresponding change in the number of pieces.
— Remove multiple jumps.
— Allow pieces to move in all directions, as though you had a board of kings.
— Change the shape of the board, to become hexagonal, rectangular or five-sided.
— Add one or two special pieces, such as one which can move like the queen in chess.
— Introduce a new method of capture, such as 'squeezing' a piece between two of the opponent's pieces.
— Change the object of the game, so that the player who first makes three kings wins, or the first player to get rid of all of his or her pieces is the victor.
— Make the game three-handed, and allow the computer to play two of the hands, with the human as the third player.

And so on. I am sure there are many other ideas you can think of which fit under the umbrella of 'checkers derivatives'.

Mancala

One of the oldest known games is known by a number of names, including 'Mancala', 'Owari', 'Awari' and 'Kalah'. Mancala boards have been discovered in 3000 year old Egyptian temples. It is still widely played in Africa and Asia, often under slightly different rules.

The basis of the game is for both players to have a number of 'cups' (or depressions in the ground) in a row in front of them. There is a larger 'home cup' at each end of the rows. The playing field looks like that shown in Fig.1, with the home cups designated by the letter H.

```
                      Computer's side
                       o  o  o  o  o  o
Human's home   H                          H   Computer's home
                       o  o  o  o  o  o
                        Human's side
```

At the start of the game, each cup contains a number of seeds (generally four or six), with the home cups empty. The players take it in turn to move. All of the stones in one cup are picked up, and the player then moves in a clockwise (or anti-clockwise, in some versions of the game) direction, dropping a single seed into each cup (except the home cups) as it is passed over.

If the final seed lands in an empty cup on the player's side, then all the seeds in the facing, opponent's cup are transferred into the player's home cup. The game continues until one of the players cannot move, which will happen when there are no seeds on his or her side. The winner is the player with the most seeds in the home cup.

Other variations of the game allow for a seed to be dropped in the player's home cup, but not the opponent's one, on each move. If the final seed lands in a player's home cup, the player has a second move.

This seems a simple game, and it is relatively easy to program. In fact, in an article on the game in *Creative Computing* magazine (pp. 166-171, May 1980) David Levy points out that 'the game presents an ideal programming exercise because the rules are simple . . . and it is relatively easy to devise a satisfactory evaluation function'.

Despite the simplicity of play, Sid Sackson claims in his book *A Gamut of Games* (Pantheon Books, New York, 1982), although the game is 'at first glance deceptively simple . . . with repeated play the many subleties of the strategy begin to emerge'. L D and P H Stander, in an article in *Microcomputing* (pp. 118-120, November 1979) agree, claiming that 'competently played, Mancala can be as challenging as chess'.

Card games

I won't even attempt to list card games in this article, as you're sure to know several of them, and books of card games rules are easy to acquire. Most card games can become computer games by (a) simplifying the rules; (b) reducing the number of cards; and/or (c) replacing the cards with a set of dice.

Poker, for example, can be viewed as the basis for many games in which particular combinations of cards (or numbers, if you're using dice) have higher values than others. The rules by which you exchange unwanted cards or numbers for new ones can determine the nature of the game. No exchange, and you have a simple game of chance. Limited exchange, and chance still plays a part, although skill is required to know which cards to discard. Unlimited exchange, and the skill factor becomes far more important.

Out on the field

You may wish to try and write a game which simulates an outdoor sport, such as football, tennis or baseball.

The simulation can be based on similar games played with cards or dice, or you can follow a completely different route, and use the graphics potential of your computer, to produce a game which is played in real-time.

Proprietary board games

Although you cannot develop such programs for commercial sale (as they may infringe the copyright on the original version), proprietary games are a rich source of program ideas.

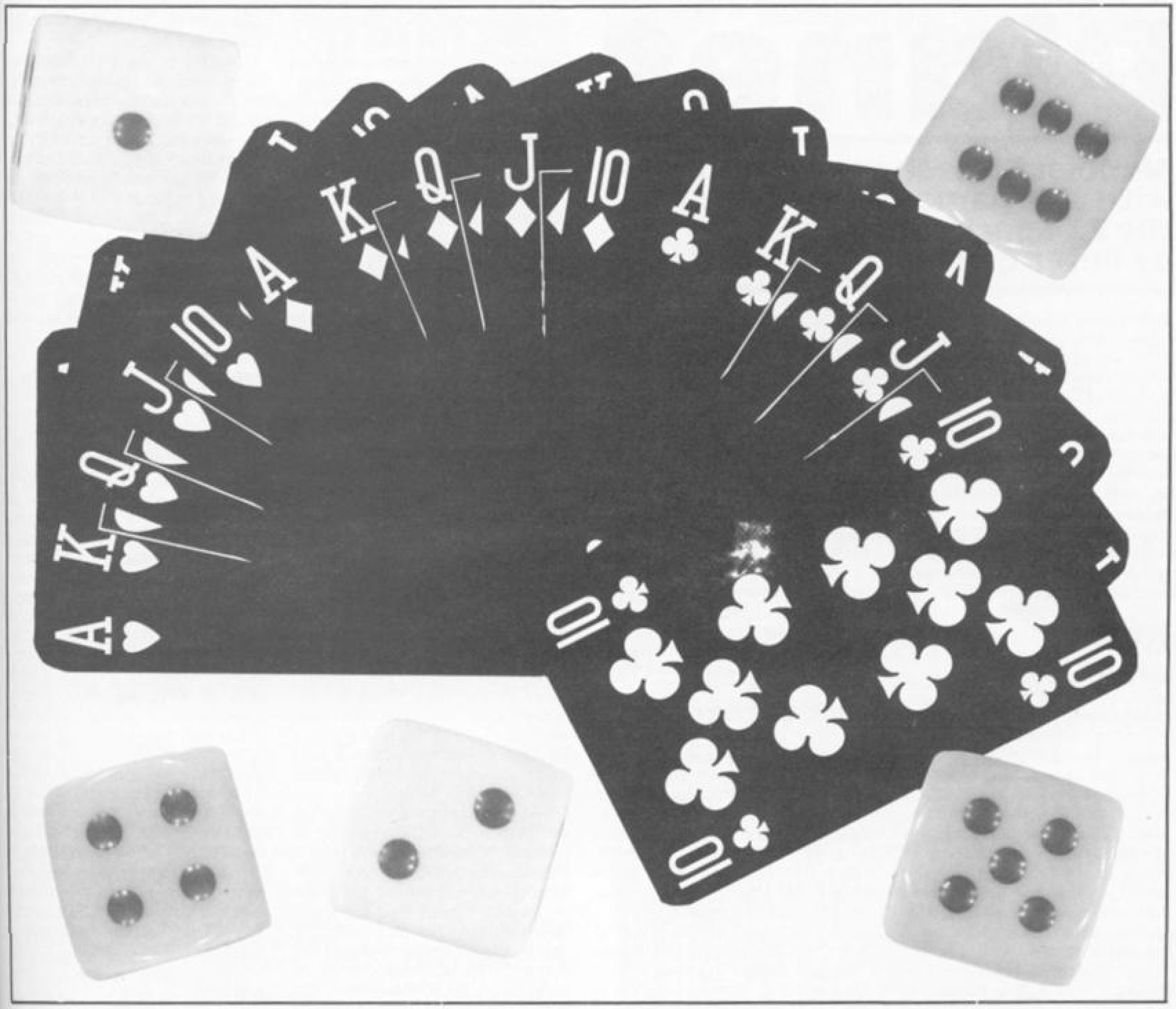
Obvious targets such as Monopoly (*Parker Brothers*) and Diplomacy (*Avalon Hill*) suggest themselves, but there are many others which deserve consideration. These include Cluedo (*Parker Brothers*) in which a murder must be solved; Oregon Trail (*Fantasy Games Unlimited*) in which you attempt to cross the western United States while coping with Indians and a far from hospitable environment; and Kensington (*Samuel Ward*) in which players move interlocking shapes in an attempt to relocate opponent's pieces by surrounding a triangle or square, and in which surrounding a hexagon wins.

Have a look through any large toy or games shop and you'll discover many, many worthwhile ideas.

Dice games

A book which concentrates on these is the obvious place to get detailed breakdowns of both the game and suggested strategy, but I'll mention a few here which may prove interesting and of value:

Craps — Two dice are rolled. If the total is 7 or 11, the player



wins immediately. If the total is 2, 3 or 12 ('craps') the player loses, and the dice are handed to the other player for his or her move. Any other total is called the 'point'. The player attempts to roll his or her point again, before rolling a 7. If a 7 is rolled first, the player loses.

Twenty-one — This is the card game pontoon played with two dice.

Pig — A single die is used. Players try to get a total of 100 points. Players can end their turn at any time, and hand the die to the opponent. A player's total reverts to zero if a 1 is rolled.

Chuck-a-luck — Three dice are used in this game based on Crown and Anchor. The player (or players) chooses a number from 1 to 6, and places a bet on this number. The three dice are thrown and each one which comes up with the players number pays back the value of the bet. Therefore, if just one of the three dice lands showing the chosen number, the player gets his or her money back. Two dice showing the number, and twice the value of the bet is returned, and so on.

Fantasy and role-playing games

If you enjoy games like *TSR Hobbies'* Dungeons and Dragons (the game and name are registered trademarks of TSR) then you're sure to be interested in games which explore the same fantasy worlds. There are many commercial programs which cover this field. Examining these will give you some clues on how to proceed in writing your own.

A particularly useful book to assist you in this is *Writing BASIC Adventure Programs for the TRS-80* (Frank Dacosta, TAB Books Inc , 1982). Despite being written specifically for the TRS-80, you'll find a great deal of value in it, no matter which computer you use.

Other sources of ideas

There are many, many games books which can give you ideas for programs. Among those I've found most suitable for this task are:

THE COMPLETE BOOK OF INDOOR GAMES — edited by Peter Arnold, Rigby Publishers Ltd, 1982.
A PLAYER'S GUIDE TO TABLE GAMES — John Jackson, Stackpole Books, 1975.
A GAMUT OF GAMES — Sid Sackson, Pantheon Books, 1982.
GAMES FOR TWO — John Wasley, Proteus Publishing Co Inc, 1981.
DICE GAMES NEW AND OLD — William E Tredd, The Oleander Press, 1981.
DISCOVERING OLD BOARD GAMES — RC Bell, Shire Publications Ltd, 1980.
DISCOVERING DICE AND DOMINOES — RC Bell, Shire Publications Ltd, 1980.
DICING WITH DRAGONS, AN INTRODUCTION TO ROLE-PLAYING GAMES — Ian Livingstone, Routledge & Kegan Paul, 1982.
EVERYMAN'S INDOOR GAMES — Gylès Brandreth, JM Dent & Sons Ltd, 1982.

Planet

An object lesson in geometry with this games program for the ZX Spectrum written for us by Peter Cameron of Oxford.

This program began as an experiment in drawing three-dimensional shapes from different vantage points — a branch of geometry once of practical importance but now (along with much other geometric manipulations) on the decline in educational fashion. My aim was to compute and display successive views of an object as seen by a moving observer. The final result also involves a little Newtonian mechanics and graph theory.

In a fix?

Let us take a fixed reference point, O, in space as the origin, and locate any point relative to O by three co-ordinates (x,y,z) representing its distance, East, North (the two-dimensional map reference) and in the vertical direction. The screen should be made to display a photograph of an object taken by an observer at co-ordinates (l,m,n). (To simplify matters, we assume that the vertical direction in space is taken to be at the top of the screen.)

Some algebraic manipulation showed that if O is plotted at the centre of the screen (pixel 128,88) then the point with co-ordinates (1,0,0) should be plotted at 128+x1, 88+y1, co-ordinates (0,1,0) at 128+x2, 88+y2, and co-ordinates (0,0,1) at 128+x3, 88+y3; it should be noted that the displacements, x1, . . . y3, are given by the formulae in lines 140 to 160 of the program. These formulae include provision for the fact that the object appears smaller when viewed from further away.

With this information, an arbitary point can be plotted — the point with co-ordinates (u,v,w) would appear at pixel, 128+u*x1+v*x2+w*x3, 88+u*y1+v*y2+w*y3.

Luck of the draw

I decided to draw an octahedron. This figure has an interesting symmetrical shape which is extremely easy to draw. The corners, or vertices, are at the points (1,0,0), (0,1,0), (0,0,1) and their negatives. Line 260 of the program does the actual drawing.

You will see that the effect of line 260 is to draw the figure 'without taking the pencil from the paper' — that is, only using the PLOT instruction once. That this is possible for the octahedron was another reason for my choice of this solid. Such a figure is called Eulerian, after the mathematician Leonhard Euler, who convinced the citizens of Konigsberg that it was impossible to walk around their city crossing each of its seven bridges exactly once. Euler showed that, in order to draw a figure without lifting your pencil, it is necessary and sufficient that each vertex lies on an even number of edges (in which case, you can start anywhere but you must finish at the start point), or exactly two don't lie on the edges (when you must start at one of the edges and finish on another). It isn't necessary to demonstrate this — a routine for drawing an octahedron can be found by trial and error. (Try it yourself with a pencil and paper before making a study of line 260.)

The mechanics of the program

The position co-ordinates of the observer are (l,m,n) and the velocity is (p,q,r). This means that, in the time interval between one observation and another, l, m and n will change by amounts proportional to p, q and r respectively. This is implemented in line 400.

At first I kept the velocity fixed. However, if the observer is piloting a spaceship orbiting a planet, the velocity will also change. According to the laws of gravity discovered by Isaac Newton, the change of velocity will be in a direction towards the planet; that is, proportional to (−l, −m, −n)/SQR b, where b is computed in line 140. The proportionality factor is the inverse square of the distance from the planet, ie 1/b.

At this point, I realised that there was a 'game' element possible within my program, so I added controls, which change the velocity either towards or away from the planet. Unfortunately, the ship's engines are not very reliable and the actual change is somewhat variable but that is what games are all about, aren't they? The velocity change (due to the combined effect of gravity and engines) is implemented in line 410 and 420.

What's the score?

The object of the game is to take survey photographs of the planet; these should be as large as possible so you'll have to get in real close. The score is determined by the size of the largest image to appear on the screen, with added bonuses for a very close approach. However, have I told you about the risk of crashing?

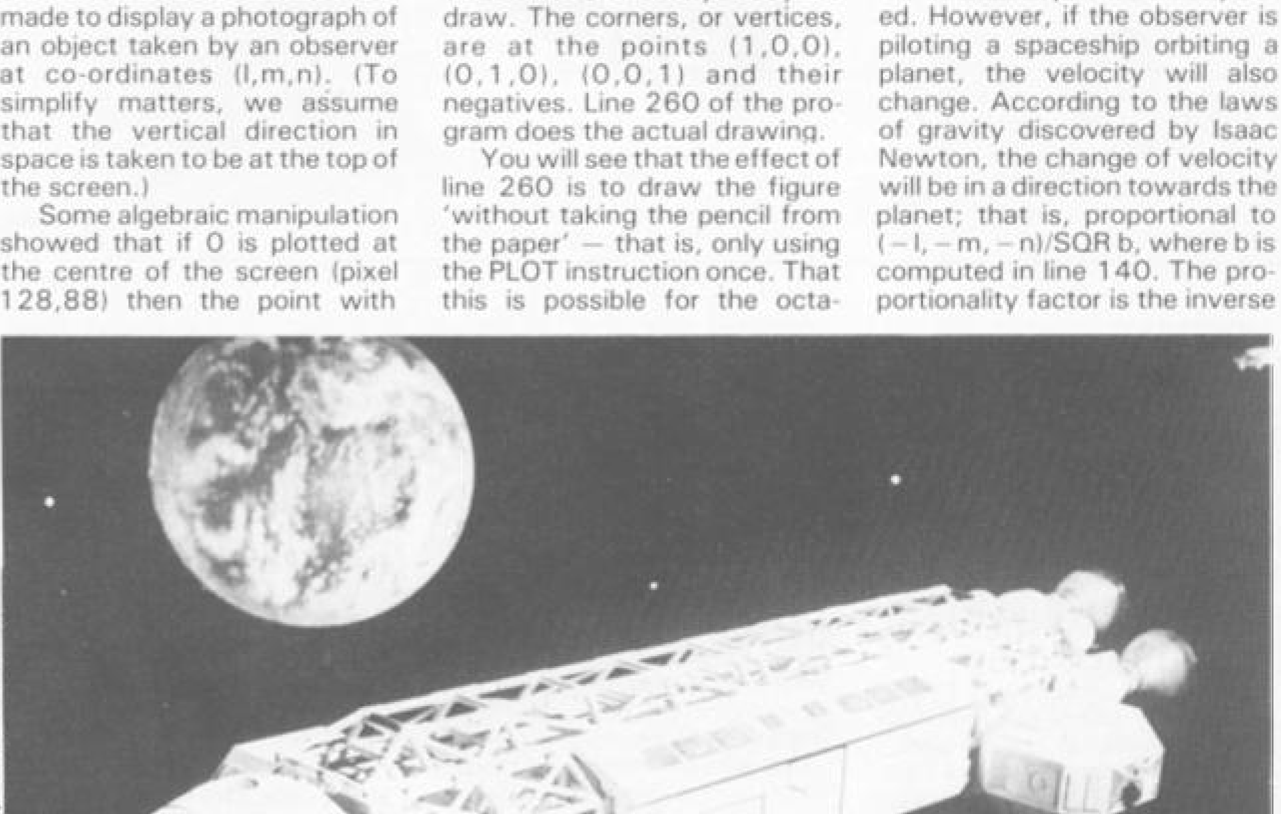
Since the controls only work slowly, there is a more drastic way of avoiding an imminent crash — a jump through hyperspace. Newton's equations didn't exactly cover this possibility (and science fiction writers are still arguing about it), so I took it upon myself to assume that re-entry from hyperspace is random, both in its position and velocity. Hyperspace jumps are expensive but spectactular (especially if you re-materialise inside a solid body!).

All change

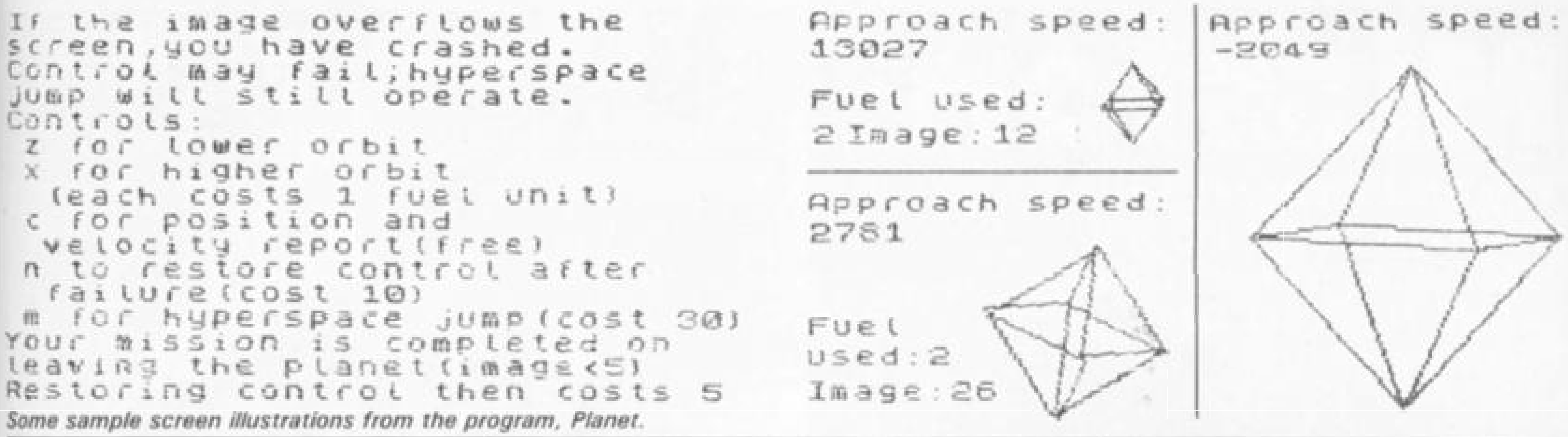
This program is written for the 16K Spectrum. However, with a few changes it could be RUN on the 48K machine. The changes are as follows:

Line 10 — Replace 31743 with 64511.
Line 60 — Replace 31744 with 64512.
Line 80 — Replace 124 (the third entry in the DATA list) with 252.
Line 550 — Replace 31744 with 64512.
Line 555 — Replace 31756 with 64524.
Line 600 — Replace 31768 with 64536.

Should you feel ambitious once you have studied the program, why not try and define your own shapes and manipulate them in three dimensions.



Photograph courtesy of Precision Video.



Some sample screen illustrations from the program, Planet.

```
  10 CLEAR 31743: BORDER 6
  20 PRINT "You are entering orb
it about"'"the octahedral planet
."'"Your aim is to make the clos
est"'"possible approach."'"If th
e image overflows the"'"screen,y
ou have crashed."'"Control may f
ail;hyperspace"'"jump will still
 operate."
  30 PRINT "Controls:"'" z for l
ower orbit"'" x for higher orbit
"'"   (each costs 1 fuel unit)"'"
 c for position and"'"  velocity
 report(free)"'" n to restore co
ntrol after"'"   failure(cost 10)
"'" m for hyperspace jump(cost 3
0)"
  40 PRINT "Your mission is comp
leted on"'"leaving the planet(im
age<5)"'"Restoring control then
costs 5"
  50 FOR i=0 TO 23
  60 READ n: POKE 31744+i,n
  70 NEXT i
  80 DATA 33,24,124,17,0,88,1,0,
3,237,176,201,33,1,88,17,0,88,1,
255,2,237,176,201
  90 GO SUB 580
 100 INPUT "Enter level(1-5)";e
 110 LET fuel=0: LET size=0: LET
 d=1: LET a$="": DEF FN f(x,y)=x
+((y-x) AND y>x): LET k=1+e/4
 120 LET p=-2*k*RND: LET q=-2*k*
RND: LET r=-2*k*RND
 130 LET l=4*RND: LET m=4*RND: L
ET n=4*RND
 140 LET a=l*l+m*m: LET b=a+n*n
 150 LET x1=40*m/(SQR a*SQR b):
LET x2=-x1*l/m: LET x3=0
 160 LET y1=40*l*n/(b*SQR a): LE
T y2=y1*m/l: LET y3=-40*SQR a/b
 170 LET s=FN f(ABS x1,ABS x2)
 180 IF s>=128 THEN GO TO 450
 190 LET w=FN f(ABS y3,ABS y2):
LET t=FN f(ABS y1,w)
 200 IF t>=88 THEN GO TO 450
 210 LET image=FN f(s,t): LET si
ze=FN f(size,image)
 220 BORDER 6: PAPER 7: FLASH 0:
 CLS
 230 IF image<5 THEN GO TO 490
 240 IF d=0 THEN PRINT AT 0,15;
INK 2; FLASH 1;"Control failure"
: GO TO 260
 245 PRINT AT 0,0; INK 0;"Approa
ch speed:";-INT (1000*(l*p+m*q+n
*r))
 250 IF a$="c" THEN PRINT INK 0;
"Coordinates:";INT (1000*l);",";
INT (1000*m);",";INT (1000*n)'"V
elocity:";INT (1000*p);",";INT (
1000*q);",";INT (1000*r)
 260 INK 1: PLOT 128+x1,88+y1: D
RAW x3-x1,y3-y1: DRAW x2-x3,y2-y
3: DRAW -x1-x2,-y1-y2: DRAW -x2+
x1,-y2+y1: DRAW -x3+x2,-y3+y2: D
RAW x1+x3,y1+y3: DRAW -x2-x1,-y2
-y1: DRAW x3+x2,y3+y2: DRAW -x1-
x3,-y1-y3: DRAW -x3+x1,-y3+y1: D
RAW x2+x3,y2+y3: DRAW x1-x2,y1-y
2
 270 INK 0: PRINT AT 21,0;"Image
:";INT image
 280 PRINT AT 21,18;"Fuel used:"
;fuel
 290 LET a$=""
 300 FOR i=1 TO 200/2↑e
 310 IF INKEY$="m" THEN GO TO 54
0
 320 IF INKEY$="" THEN GO TO 340
 330 LET a$=INKEY$
 340 NEXT i
 350 IF a$="n" AND d=0 THEN LET
d=1: LET fuel=fuel+10
 360 LET c=0
 370 IF a$="z" THEN LET c=-1
 380 IF a$="x" THEN LET c=1
 390 IF d=1 THEN LET d=1-INT (RN
D*(1+k/200))
 400 LET l=l+p/20: LET m=m+q/20:
 LET n=n+r/20
 410 LET u=b*SQR b/(2*k): LET v=
c*d/SQR b
 420 LET p=p-l/u+v*l*RND: LET q=
q-m/u+v*m*RND: LET r=r-n/u+v*n*R
ND
 430 LET fuel=fuel+ABS c*d
 440 GO TO 140
 450 REM crash
 460 BORDER 2: PAPER 2: CLS
 470 PAUSE 0
 480 GO TO 100
 490 REM mission completed
 500 CLS
 510 PRINT AT 9,7; FLASH 1;"Miss
ion completed"
 520 PRINT AT 11,12; FLASH 1;"Sc
ore:";INT (2*(size+2*((size-50)
AND size>50)+10*((size-80) AND s
ize>80)))-fuel-5*(1-d)
 530 GO TO 100
 540 REM hyperspace jump
 545 CLS
 550 LET w=USR 31744
 555 FOR i=1 TO 200: LET x=USR 3
1756: POKE 23295,128+INT (RND*64
): NEXT i
 560 LET fuel=fuel+30
 565 LET l=3*RND: LET m=3*RND: L
ET n=3*RND
 570 LET p=2*k*(2*RND-1): LET q=
2*k*(2*RND-1): LET r=2*k*(2*RND-
1)
 575 GO TO 140
 580 REM set up random attribute
 array
 590 FOR i=0 TO 767
 600 POKE 31768+i,128+INT (RND*6
4)
 610 NEXT i
 620 RETURN
```

Mission

Try and infiltrate the enemy's secret base with Adam Freed and Steve Hackett of Bognor Regis.



In this game for the 16K ZX81, you pose as a soldier behind enemy lines and your mission (should you decide to accept it) is to get into the secret base at the top of the screen.

The secret base is placed behind a grey wall and looks fairly easy to reach, apart from the fact that the enemy are on your tail. You are represented by a cross and you get to move ten spaces at a time. Your moves can be either North, South, East or West and these are carried out through the use of the 'N', 'S', 'E' or 'W' keys.

Once you have made your move, the computer decides the enemy 'planes bombing route. Fortunately for you, their aircraft are not equipped with radar, but they do know your previous position. However, as you make more moves, the bombing becomes more intense — this is controlled by the value of the variable, O, in line 1009.

Program description

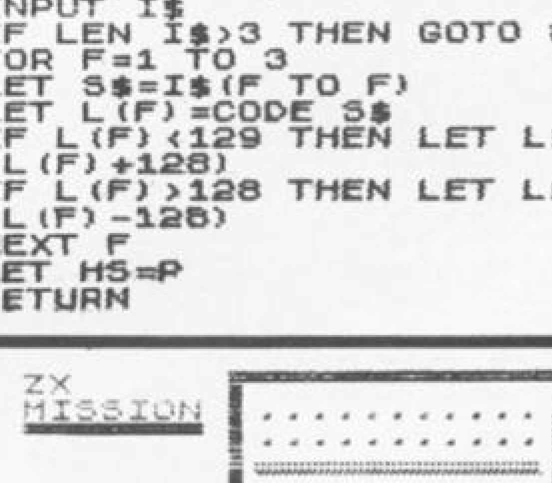
Here follows a brief description of the program:

Lines 1-600	Set the variables, print the screen display and cater for your moves.
Lines 1000-1120	Make the enemy bombing moves.
Lines 2000-2090	Increase your score and the number of bombs dropped as your character gets nearer to the grey wall.
Lines 4000-4030	These lines tell you that you have used up all the moves you can make this turn.
Lines 6000-6040	This routine controls you getting bombed.
Lines 6041-6120	This is the 'high score' routine and controls the offer of another game.
Lines 9000-9060	These lines contain the on-screen instructions.

```
   1 LET HS=0
   2 LET L$=""
   3 GOSUB 7000
   4 LET P=0
   5 LET O=3
   6 LET LV=1
```

```
   8 CLS
   9 FAST
  10 GOSUB 500
  11 FOR A=0 TO 21
  20 PRINT AT A,8;"▌............▐
"
  30 NEXT A
  40 FOR A=8 TO 20
  50 PRINT AT 0,A;"▀";AT 3,A;"▒"
;AT 21,A;"▄"
  60 NEXT A
  70 PRINT AT 0,8;"▛";AT 0,20;"▜
";AT 3,8;"▌ ";AT 3,20;" ▐";AT 21,8
;"▙";AT 21,20;"▟"
  75 SLOW
  77 PRINT AT 13,1;"██████"
  79 FOR A=11 TO 15
  80 PRINT AT A,3;"█"
  85 NEXT A
  86 PRINT AT 10,3;"N";AT 13,0;"
W";AT 13,6;"E";AT 16,3;"S"
  88 PRINT AT 0,0;"ZX"
  89 PRINT AT 20,0;"LEVEL ";LV
  90 PRINT AT 1,0;"MISSION"
 100 PRINT AT 2,0;"███████"
```

```
 110 PRINT AT X,Y;"⊠"
 111 LET B=X
 112 LET C=Y
 120 PRINT AT 5,2;Y$;TAB 2;Z$
 125 FOR A=0 TO 3
 130 INPUT R$
 135 IF R$="N" AND X-1<1 THEN GO
TO 130
 136 IF R$="E" AND Y+1>19 THEN G
OTO 130
 137 IF R$="S" AND X+1>20 THEN G
OTO 130
 138 IF R$="W" AND Y-1<9 THEN GO
TO 130
 140 IF R$="N" THEN LET X=X-1
 145 IF R$="E" THEN LET Y=Y+1
 150 IF R$="S" THEN LET X=X+1
 155 IF R$="W" THEN LET Y=Y-1
 157 IF X<3 THEN GOTO 2000
 160 NEXT A
 165 LET M=M+1
 166 IF M>10 THEN GOTO 4000
 170 PRINT AT X,Y;"X"
 180 GOSUB 1000
 200 GOTO 110
 500 LET X=20
 510 LET Y=14
 520 LET M=0
 540 LET Y$="YOUR"
 550 LET X$="MY"
 560 LET Z$="MOVE"
 570 LET N=0
 580 LET E=0
 590 LET S=0
 600 LET W=0
 610 DIM I$(3)
 615 IF L$<>"" THEN GOTO 630
 620 DIM L$(3)
 630 DIM L(3)
 670 RETURN
1000 PRINT AT 5,2;" ";X$;" ";TAB
 2;Z$
1009 FOR J=1 TO O
1010 LET G=INT (RND*7)-3
1020 LET H=INT (RND*7)-3
1030 IF (G+B)>20 OR (G+B)<1 OR (
H+C)>19 OR (H+C)<9 THEN GOTO 101
0
1050 PRINT AT (G+B),(H+C);"▒"
1060 IF (G+B)=X AND (H+C)=Y THEN
 GOTO 6000
1080 FOR A=0 TO 5
1090 NEXT A
1100 PRINT AT (G+B),(H+C);"."
1110 NEXT J
1120 RETURN
2000 FOR A=0 TO 20
2010 PRINT AT X,Y;"X";AT X,Y;"⊠"
2020 NEXT A
2030 LET O=O+1
2040 LET LV=LV+1
2050 PRINT AT 0,22;"YOU HAVE";AT
 1,22;"MADE IT."
2051 PRINT AT 4,22;"BONUS"
2052 PRINT AT 7,22;"SCORE"
2053 FOR A=90 TO 0 STEP -10
2054 PRINT AT 5,23;A;"  "
2056 LET P=P+10
2057 PRINT AT 8,23;P
2058 NEXT A
2060 FOR A=0 TO 100
2070 NEXT A
2080 CLS
2090 GOTO 8
4000 LET P=P+((21-B)*5)
4005 PRINT AT 0,22;"YOU HAVE";AT
 1,22;"USED ALL";AT 2,22;Y$;AT 3
,22;"MOVES.";AT 5,22;Y$;AT 6,22;
"SCORE WAS";AT 7,22;P
4010 FOR A=0 TO 50
4020 NEXT A
4030 GOTO 6041
6000 PRINT AT 0,22;"I BOMBED";AT
 1,22;"YOU."
6010 FOR A=0 TO 20
6020 PRINT AT (G+B)-5,(H+C)-5;"X
";AT (G+B)-5,(H+C)-5;"▒"
6030 LET P=P+((21-B)*5)
6040 PRINT AT 3,22;Y$;AT 4,22;"S
CORE WAS";AT 5,22;P
6041 IF P>HS THEN GOSUB 8000
6050 FOR A=4 TO 20
6060 PRINT AT A,9;"                    "
6070 NEXT A
6080 PRINT AT 1,9;"HIGH SCORE="
6090 PRINT AT 2,9;HS;" BY ";L$(1
 TO LEN I$)
6100 PRINT AT 8,9;"PRESS ANY";AT
 9,9;"KEY TO PLAY";AT 10,9;"AGAI
N"
6110 IF INKEY$="" THEN GOTO 6110
6120 GOTO 4
7000 PRINT AT 0,11;"ZX MISSION"
7010 PRINT AT 1,10;"▀▀▀▀▀▀▀▀▀▀▀▀
"
7020 PRINT AT 3,0;"   YOU ARE A
SOLDIER TRYING TO  GET INTO THE
ZX81 HEADQUARTERS  AT THE TOP OF
 THE GRID. TO DO   THIS YOU MUST
 GET PAST THE GREY LINE, BUT BEW
ARE AS I WILL BOMB YOU WITH MY A
IRCRAFT."
7030 PRINT "   ENTER YOUR MOVES
AS N,E,S ANDW FOR THE COMPASS PO
INTS. YOU    MAY MOVE UP TO FOUR
SQUARES IN   ONE GO. IF YOU REACH
 MY BASE I   WILL DEPLOY MORE AIR
CRAFT TO TRYAND STOP YOU."
7040 PRINT "   MY AIRCRAFT, HOWE
VER ARE NOT FITTED WITH RADAR BU
T WE BOMB ONTHE OFF-CHANCE OF A
DIRECT HIT."
7050 PRINT ,,,,"PRESS ANY KEY WH
EN YOU ARE READY"
7060 IF INKEY$<>"" THEN RETURN
7080 GOTO 7060
8000 PRINT AT 9,22;"YOU HAVE";AT
 10,22;"BEATEN";AT 11,22;"THE HI
GH";AT 12,22;"SCORE.";AT 14,22;"
ENTER ";Y$;AT 15,22;"INITIALS."
8010 INPUT I$
8020 IF LEN I$>3 THEN GOTO 8010
8030 FOR F=1 TO 3
8040 LET S$=I$(F TO F)
8050 LET L(F)=CODE S$
8060 IF L(F)<129 THEN LET L$(F)=
CHR$ (L(F)+128)
8070 IF L(F)>128 THEN LET L$(F)=
CHR$ (L(F)-128)
8080 NEXT F
8090 LET HS=P
8100 RETURN
```



A sample screen illustration from the program, Mission.

JUST AROUND THE CORNER, A NEW RA

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Alien Intruder/Hieroglyphics — Both programs make good use of graphics and words to make a very entertaining package. *Sinclair User Aug 82*
Alien/Hieroglyphics/Wumpus/Movie — A varied mix from Carnell, all featuring imaginative responses and graphics and all of them good games for all ages (Hieroglyphics is particularly good for children). *Popular Computing Weekly Aug 82*



THE DEVIL RIDES IN

I uttered the last incantations as the clock struck thirteen. All fell silent except for a faint rustling in the corner. From out of the shadows they came, all Hell's fury against me but I was not defenseless until the Angel of Death, astride a winged horse, joined the battle. Avoiding his bolts of hell fire, I took careful aim. My chances were slim, but if my luck held.

(Fast moving, machine code, all action, Arcade game)

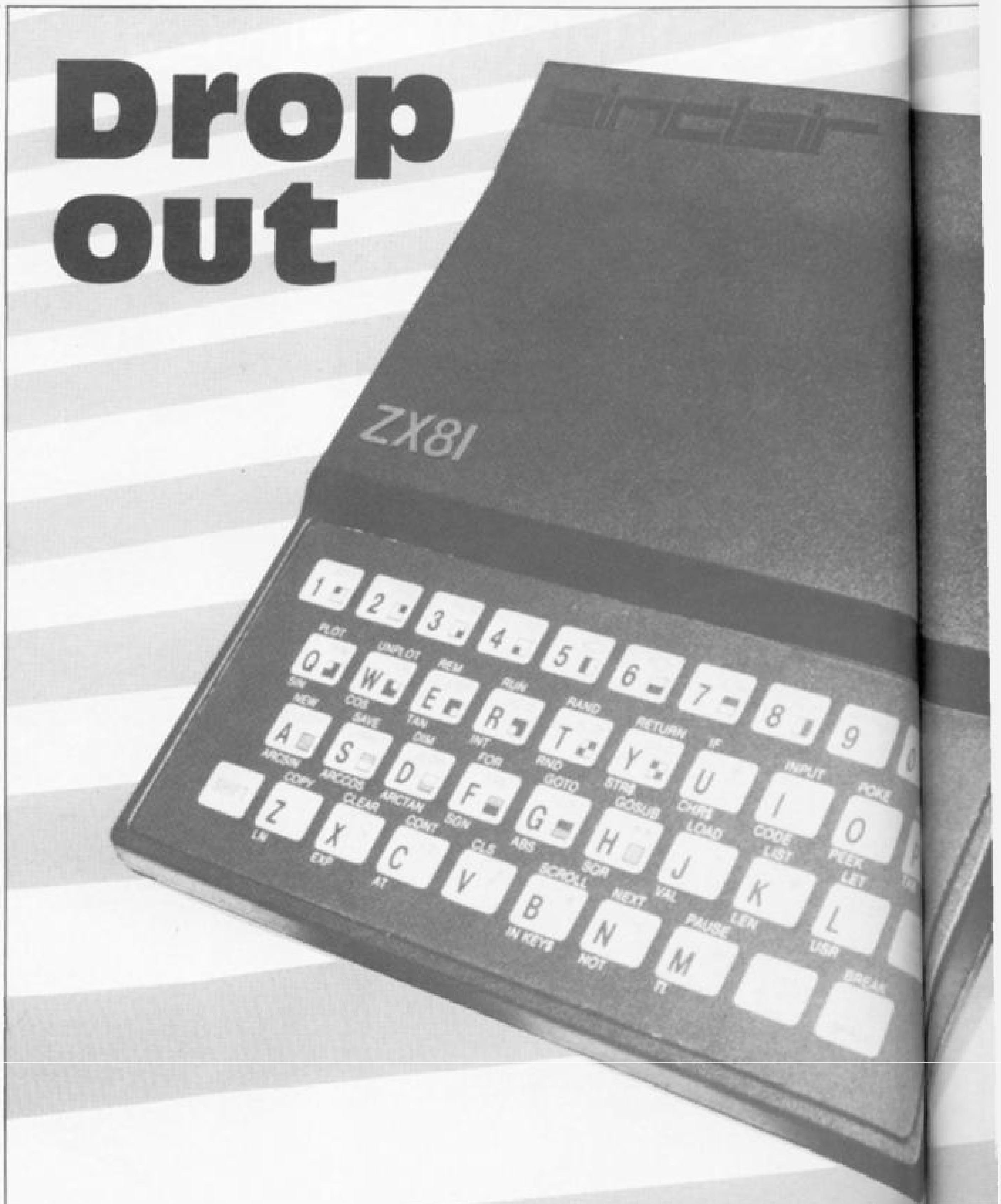
The above are available through most good computer stores or direct from:

CARNELL SOFTWARE LTD.,

North Weylands Ind. Est., Molesey Road, Hersham, Surrey KT12 3PL.

DEALERS: Contact us for your nearest wholesaler.

Drop out



This is a game for the ZX81 with at least 3½K of RAM and has been written so that, apart from the enjoyment I hope you'll get from the game, you will also learn more about the capabilities of the computer.

The idea of the game is to drop your arrow, a 'V', into the mouth of a bottle. If you miss the mouth of the bottle or land in one of the other bottles, you score the amount of points indicated at the bottom of the bottle (printed in inverse print). You have ten attempts to score as many points as possible, and you lose one of your goes for each 'V' dropped. To drop a 'V', press any key apart from Break or Shift.

Gotta lotta bottle

When the program is RUN, the bottles appear and your '>' moves rapidly across the screen. Pressing a key will make your arrow fall from its path, hopefully into the mouth of a bottle. When your ten attempts have been exhausted, your score and the highest score so far will be displayed.

The program uses the memory mapped display of the ZX81 with at least 3½K. I have deliberately not included instructions in my program so that users with more than 1K but less than 16K can also enjoy the game.

I have used variables to represent areas of the program, for example:

70 GOSUB DRAWG

This line makes the program go to the subroutine to print the bottles.

Outline

Here follows a brief explanation of some of the more important lines of the program:

5	— Initialises the main variables used in the program.
10	— Finds the beginning of the display file.
20	— The starting position of your arrow character.
210-230	— The routine to find out if your arrow has hit anything.
280	— The routine to print on the screen how much you scored.
710	— Prints your points on the screen.

If the user wishes to have a delay before the game starts, he or she should add the line:

7 PAUSE 4E4

Then, by pressing a key, the game will start. When the program has been typed in, RUN 9000 will SAVE the program to tape and will then RUN the main program.

```
   5 GOSUB 9000
   6 REM **R.A.M. USED: 3.5K**
  10 LET DFILE=PEEK 16396+256*PE
EK 16397+1
  20 LET HM=DFILE+198
  30 LET HI=0
  40 LET ATT=10
  50 LET S=0
  60 CLS
  70 GOSUB DRAWG
  80 FOR X=0 TO 31
  90 POKE HM+X,18
 110 IF INKEY$<>"" THEN GOTO DRO
P
 120 POKE HM+X,0
 130 NEXT X
 140 GOTO 80
```



SP Stratford of Hemel Hempstead presents us with a ZX81 version of the popular arcade game.

```
 199 REM **DROP**
 200 POKE HM+X,187
 210 FOR Y=1 TO 16
 220 IF PEEK (HM+X+(Y*33))=128 T
HEN GOTO 270
 230 IF PEEK (HM+X+(Y*33))<>0 TH
EN GOTO SCORE
 240 POKE HM+X+(Y*33),59
 250 POKE HM+X+(Y*33),0
 260 NEXT Y
 269 REM **NO SCORE**
 270 LET B$="NO SCORE."
 280 GOSUB DISPLAY
 290 LET ATT=ATT-1
 300 IF ATT=0 THEN GOTO END
 310 GOTO 60
 399 REM **SCORE**
 400 LET SC=PEEK (HM+X+(Y*33))
 410 LET SC=SC-156
 420 GOSUB 430+(10*SC)
 425 LET S=S+SC
 427 GOTO 280
 430 GOTO 270
 440 LET B$="YOU SCORE 1 POINT."
 445 RETURN
 450 LET B$="YOU SCORE 2 POINTS.
"
 455 RETURN
 460 LET B$="YOU SCORE 3 POINTS.
"
 465 RETURN
 470 LET B$="YOU SCORE 4 POINTS.
"
 475 RETURN
 480 LET B$="YOU SCORE 5 POINTS.
"
 485 RETURN
 490 LET B$="YOU SCORE 5 POINTS.
"
 495 RETURN
 499 REM **END**
 500 LET B$="                    
            "
 510 LET C$=B$(1)+"
                   "+B$(1)
 520 CLS
 530 PRINT AT 0,0;B$;AT 21,0;B$
 540 FOR N=1 TO 20
 550 PRINT AT N,0;C$
 560 NEXT N
 570 IF HI<S THEN LET HI=S
 580 PRINT AT 2,10;"DROP-OUT";AT
 3,10;"         "
 590 PRINT AT 5,8;"YOU SCORED...
";S
 600 PRINT AT 7,8;"YOUR HIGH....
";HI;TAB 10;"SCORE"
 610 PRINT AT 10,7;"WOULD YOU LI
KE TO";AT 12,8;"TRY AGAIN AND";A
T 14,9;"IMPROVE YOUR";AT 16,12;"
SCORE?"
 620 IF INKEY$="N" THEN GOTO 650
 630 IF INKEY$="" THEN GOTO 620
 640 GOTO 40
 650 PRINT AT 18,6;"SEE YOU AGAI
N; I HOPE."
 660 STOP
 699 REM **DISPLAY**
 700 LET P$="
               "
 710 PRINT AT 1,((32-LEN B$)/2);
B$
 720 FOR I=1 TO 100
 730 NEXT I
 740 PRINT AT 1,0;P$
 750 RETURN
 799 REM **DRAWG**
 800 PRINT AT 0,3;"SCORE ";S;" A
TTEMPTS LEFT ";ATT
 810 IF ATT<10 THEN PRINT AT 0,3
1;" "
 820 PRINT AT 14,0;
 830 PRINT "                     
            "
 840 LET U$="                    
            "
 850 FOR H=15 TO 20
 860 PRINT AT H,0;U$
 870 NEXT H
 880 PRINT "  3   1   2   0   1
 5   0   6 "
 890 RETURN
8999 REM **INITIALISE**
9000 LET DRAWG=800
9010 LET DISPLAY=900
9020 LET END=500
9030 LET DROP=200
9040 LET SCORE=400
9100 RETURN
9200 SAVE "DROP-OUT"
9210 RUN 5
```

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Grovey bug

A game to drive you round the bend from Paul Ralphs of Manchester.

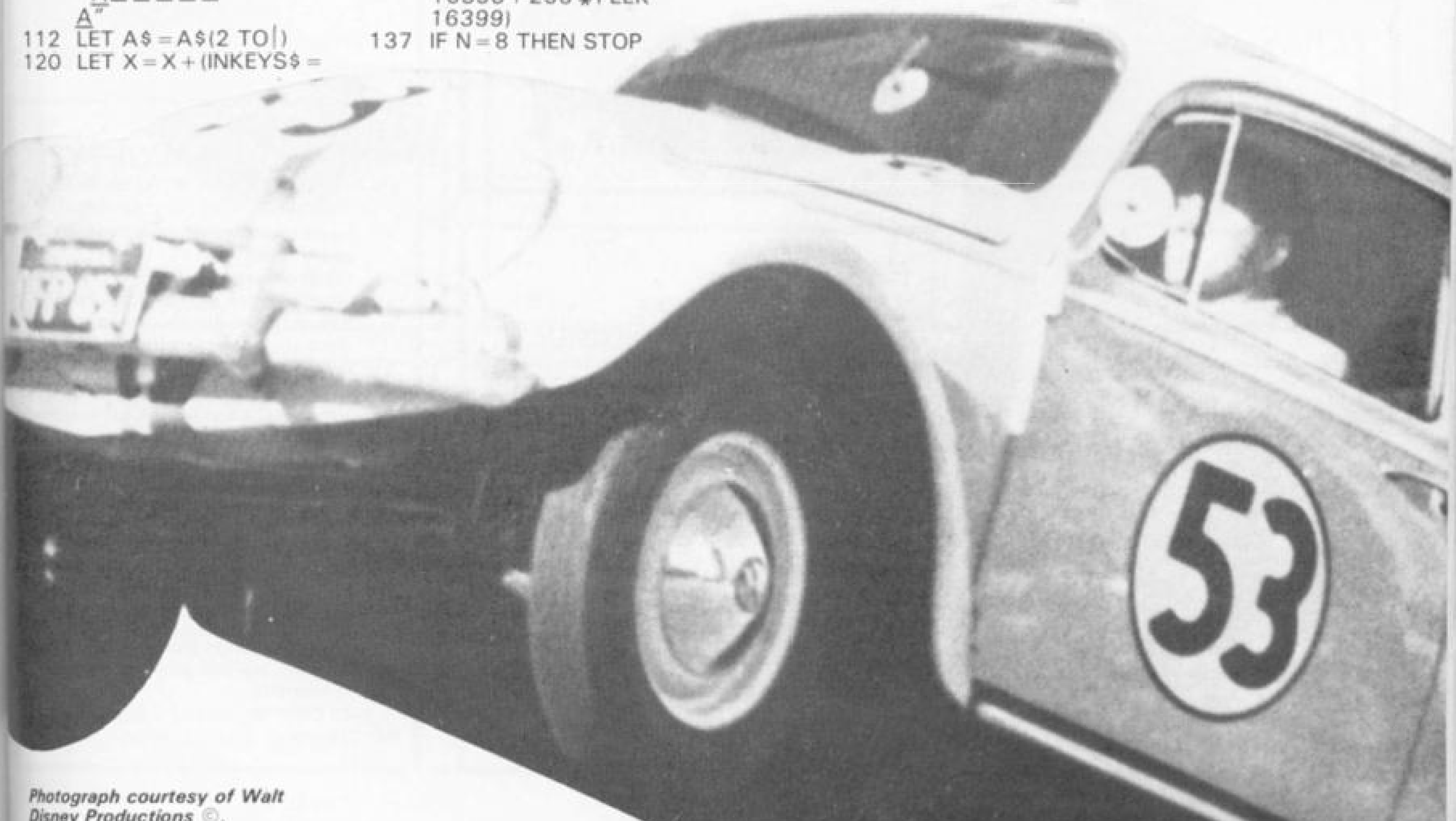
Based on an arcade game, this program is very enjoyable and extremely addictive.

The object of the game is to steer your buggy along the road using the '5' and '8' keys to move left and right respectively. The road is defined in line 20 and is programmed in such a simple way to allow you to alter the graphic characters to suit yourself; the graphic characters can be changed to any whose code are in the number range 1 to 10 if you are using an unexpanded ZX81 — if more 1K is available, then you can use graphic characters with codes of 1 to 15.

I think the inverse 8 character is quite a good representation of a buggy (from the top), but I will admit that it could be done a little bit better with the advantage of more memory. The program is very fast for BASIC and should thus be run in Slow mode.

```
10  LET X=PI/PI
20  LET A$="12745TEAD
    SDAET54721"
105 LET Z=(CODE A$)
110 PRINT TAB Z;
    "A■■■■■■
    A"
112 LET A$=A$(2 TO|)
120 LET X=X+(INKEYS$=
    "8")-(INKEYS$=
    "5")
130 PRINT AT 10,X;"8"
134 PRINT AT 11,X;
135 LET N=PEEK (PEEK
    16398+256*PEEK
    16399)
137 IF N=8 THEN STOP
140 PRINT AT 10,X; "■"
150 SCROLL
160 GOTO 105
```

Note that all characters underlined should be the graphics character of that key.



Photograph courtesy of Walt Disney Productions ©.

Caterpillar 2

An addictive game for your ZX81 from Derek Scott of Hawick, Scotland.

You'll need some skillful playing if you reckon on getting out of the field in one piece in this program.

The object of the game is to guide a caterpillar through a field eating cabbage leaves (made up of 'fuzzy' squares). The caterpillar must avoid touching the walls (made up of inverse spaces) and eventually escape through a small gap in the wall.

The game has a high score facility which asks for your name if you have beaten the previous player's high score. There are three skill levels, but you won't be able to get onto level three unless you have managed to score 1,000 points or more.

Program description

Lines	Description
10-115	The instructions and the skill level.
200-500	The main body of the program.
600-660	The high score facility.
1500-1530	The routine to decide the skill level.
2000-2010	The routine to decide whether a player is eligible to play on level three.

```
  10 SLOW
  15 LET H=0
  20 PRINT TAB 1;"CATERPILLAR 2
- D SCOTT, 1982"
  25 PRINT
  30 PRINT "DO YOU WANT A GAME?
            (YES/NO)"
  40 IF INKEY$="Y" THEN GOTO 70
  50 IF INKEY$<>"N" THEN GOTO 40
  60 PRINT "OK, GOODBYE..."
  65 STOP
  70 CLS
  72 PRINT "DO YOU WANT INSTRUCT
IONS?          (YES/NO)"
  75 LET S=0
  78 IF INKEY$<>"" THEN GOTO 78
  80 IF INKEY$="N" THEN GOTO 105
  85 IF INKEY$<>"Y" THEN GOTO 80
  90 CLS
 100 PRINT "CATERPILLAR 2 - INST
RUCTIONS","THIS IS ""CATERPILLAR
 2""-THATS 1 MORE THAN 1 AND 1 L
ESS THAN 3,  AT LEAST I THINK IT
 IS.","THE OBJECT OF THE GAME IS
 TO","GUIDE THE CATERPILLAR THRO
UGH","THE MAZE, USING KEYS ""5""
 AND ""8"". PICK UP THE CABBAG
E LEAVES AS YOU GO. AVOID ALL BL
ACK","OBSTACLES.",,"BONUS POINTS
 FOR LEAVES EATEN."
 101 PRINT AT 18,0;"PRESS NEWLIN
E TO CONTINUE"
 102 IF CODE INKEY$<>118 THEN GO
TO 102
 104 CLS
 105 PRINT "THERE ARE THREE SKIL
L LEVELS:","1 - BEGINNERS","2 -
AVERAGE","3 - MAGIC FINGERS","CH
OOSE YOUR LEVEL"
 110 INPUT Z
 111 IF Z<1 OR Z>3 THEN GOTO 110
 112 IF Z<>3 THEN GOTO 120
 115 GOTO 2000
 120 CLS
 200 FOR A=1 TO 21
 210 PRINT "█
          █"
 220 NEXT A
 230 LET P=5
 250 LET A=INT (RND*25+1)
 260 GOSUB 400
 270 GOSUB 450
 280 IF R=128 THEN GOTO 600
 290 IF RND<.7 THEN GOTO 260
 300 FOR A=1 TO 21
 310 SCROLL
 320 PRINT AT 21,0;"█
                  █"
 330 IF RND<.3 AND A>1 THEN PRIN
T AT 21,P;"▒"
 340 GOSUB 450
 350 IF R=128 THEN GOTO 600
 360 NEXT A
 370 GOTO 250
 400 SCROLL
 410 PRINT AT 21,0;"███████████
████████████████████"
 420 GOSUB 1500
 430 RETURN
 450 PRINT AT 6,P;
 460 LET R=PEEK (PEEK 16398+256*
PEEK 16399)
 470 PRINT "▒"
 480 LET S=S+1
 490 LET P=P+(INKEY$="8")-(INKEY
$="5")
 500 RETURN
 600 CLS
 601 IF H<S THEN PRINT "NEW HIGH
SCORE - ENTER NAME"
 602 IF H>=S THEN GOTO 610
 603 INPUT Q$
 605 IF H<S THEN LET H=S
 610 CLS
 620 PRINT AT 0,6;"HIGH SCORE=";
H;AT 1,8;"BY ";Q$
 625 PRINT AT 4,10;"SCORE=";S
 630 PRINT AT 7,0;"PLAY AGAIN?
(YES/NO)"
 640 IF INKEY$="Y" THEN GOTO 70
 650 IF INKEY$<>"N" THEN GOTO 64
0
 660 STOP
1500 IF Z=1 THEN PRINT AT 21,A;"
  "
1510 IF Z=2 THEN PRINT AT 21,A;"
  "
1520 IF Z=3 THEN PRINT AT 21,A;"
  "
1530 RETURN
2000 IF H<1000 AND Z=3 THEN PRIN
T "SORRY, YOU MUST SCORE OVER 10
00 TO PLAY LEVEL 3."
2005 IF H<1000 AND Z=3 THEN GOTO
 110
2010 GOTO 120
5000 CLEAR
5010 SAVE "CATERPILLAR █"
5020 RUN
```

ALTERNATIVE CHARACTERS

Getting tired of the Spectrum's character set? Why not type in this useful utility from Dave Hawke of Cornwall.

This routine for the 16K or 48K Spectrum transfers the character set from ROM to RAM and then modifies the characters. The system variable, CHARS, can then be made to point to the new character set.

When RUN, the program asks you to enter the Spectrum memory size and takes approximately two minutes to complete its task. The screen display should then show how to obtain the normal and alternate character sets and how to SAVE the bytes where the characters are located on tape.

Once you have the program typed in, all you have to do is perform some simple POKEs and you should be able to utilise the program's promise of alternative characters.

POKEing Around

For the 48K Spectrum, to obtain the new character set you have to POKE 23607,250. To SAVE the program, you should use the following:

SAVE name CODE 64000,1024

If you have a 16K machine, you should POKE 23607,123 to get to the new character set. And to SAVE the program, you should use:

SAVE name CODE 31486,1024

To return to the normal character set on either machine, you should POKE 23607,60.

Here is an example of the character set you will obtain using the program.

```
10 REM Alternate Character Set
20 BORDER 6: PAPER 6: INK 0: CLS
30 LET A=PEEK 23606+256*PEEK 23607
40 PRINT AT 21,2;"Enter Spectrum Memory Size."
50 INPUT "16 or 48 ";RAM
60 IF RAM<>16 AND RAM<>48 THEN GO TO 50
70 PRINT AT 20,6;"Please Wait 2 Minutes         Character Set being Generated."
80 IF RAM=16 THEN LET C=31488
90 IF RAM=48 THEN LET C=64000
100 REM >>Transfer and Modify<<
110 FOR N=C TO C+1024: LET B=PEEK A: POKE N,B
120 IF B/4=INT (B/4) THEN POKE N,B+2
```

```
10 REM Alternate Character Set
20 BORDER 6: PAPER 6: INK 0: CLS
30 LET A=PEEK 23606+256*PEEK 23607
40 PRINT AT 21,2;"Enter Spectrum Memory Size."
50 INPUT "16 or 48 ";RAM
60 IF RAM<>16 AND RAM<>48 THEN GO TO 50
70 PRINT AT 20,6;"Please Wait 2 Minutes         Character Set being Generated."
80 IF RAM=16 THEN LET C=31488
90 IF RAM=48 THEN LET C=64000
100 REM >>Transfer and Modify<<
110 FOR N=C TO C+1024: LET B=PEEK A: POKE N,B
120 IF B/4=INT (B/4) THEN POKE N,B+2
130 IF B/8=INT (B/8) THEN POKE N,B+4
140 IF B/16=INT (B/16) THEN POKE N,B+8
150 IF B/32=INT (B/32) THEN POKE N,B+16
160 IF B/64=INT (B/64) THEN POKE N,B+32
170 IF B=66 THEN POKE N,B+32
180 IF B=0 THEN POKE N,0
190 LET A=A+1: NEXT N: BEEP .1,25
200 REM >>Display Results<<
210 CLS : POKE 23607,C/256
220 PRINT AT 2,9;"POKE 23607,";C/256
230 PRINT '" To Obtain this Character Set."
240 POKE 23607,60
250 PRINT AT 8,9;"POKE 23607,60"
260 PRINT '" To Return to Normal Characters."
270 PRINT AT 14,0;"SAVE: -SAVE name CODE ";C;",1024"
280 PRINT '"This Basic Program may be NEWed Leaving Sub-Routine above Ramtop"''"   Press any Key to STOP"
290 PAUSE 0: CLEAR C: STOP
300 SAVE "alt char" LINE 1
```

Software selection

If you're looking for software for your ZX81, look no further than our comprehensive checklist!

The trouble with owning a ZX81 computer is that you are invariably spoilt for choice when it comes to software. Look through any computer magazine and you find yourself floundering in a sea of software titles.

Back in the April/May issue of *ZX Computing*, we published a checklist for the ZX81 and ZX Spectrum. However, since then, as you will know if you regularly check out the Software News pages, there is a wealth of new software being released all the time. So, in an effort to try and keep you up to date, here is a comprehensive selection of software titles currently available on the market.

To help you further, you will also find the type of program, either game (G), business (B), domestic (D), utility (U) or education (E), the company you should contact, the size of the program and the price of the package. At the back of the listing, you will find a list of all the companies mentioned, complete with an address at which further enquiries may be made.

And if you own a Spectrum and you're feeling a bit left out, not to worry — there'll be a checklist for Spectrum software in the Dec/Jan issue of *ZX Computing*.

Apologies

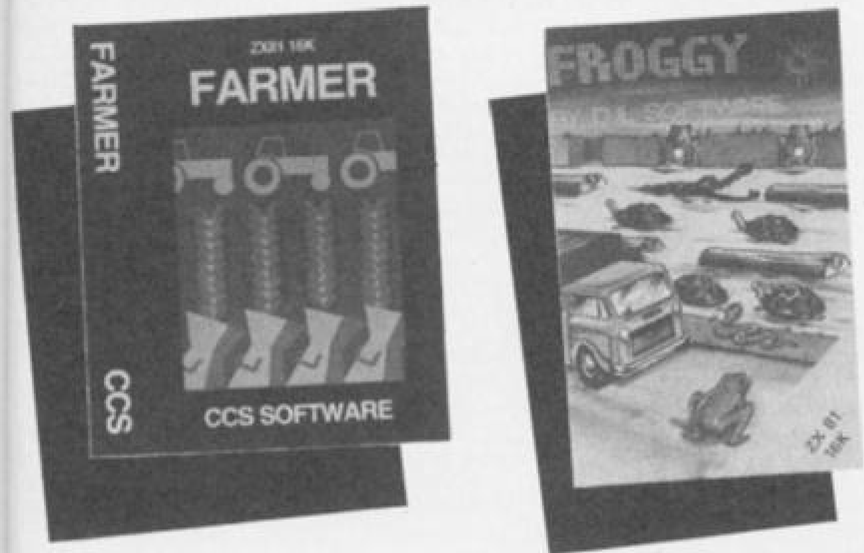
If you supply software cassettes and you do not find your products mentioned in these lists, write to *ZX Computing* and mark it for special attention for the Editor, and when it comes round to updating this feature for inclusion in a future issue, we will be able to include your software titles.

ZX81 software

1K Chess	G	Artic	1K	£2.95
1K Fun Learning	E	A Parsons	1K	£3.95
1K Games Pack	G	Artic	1K	£6.00
1K Maths	E	J Purves	1K	£3.50
1K Super Trio	G	Software Masters	1K	£7.95
16K Fun Learning	E	A Parsons	16K	£4.95
16K Games	G	Serious Software	16K	£5.95
16K Maths	E	J Purves	16K	£3.50
3-D Defender	G	New Generation	16K	£4.95
3-D Labyrinth	G	dK'tronics	16K	£3.95
3-D Monster Maze	G	New Generation	16K	£4.95
3D Space Battle	G	Impact Software	16K	£4.95
50 1K Programs	G/U/E	Educare	1K	£5.95
A.D.V.E.N.T.	G	Work Force	16K	£5.95
Accounts	D	Personal Software Services	16K	£4.95
Action Games	G	A Parsons	16K	£4.95
Adventure	G	Foilkade	16K	£5.95
Adventure	G	Abersoft	16K	£8.95
Adventure	G	Anglo American	16K	£6.00
Adventure A	G	Artic	16K	£5.95
Adventure B	G	Artic	16K	£5.95
Adventure C	G	Artic	16K	£5.95
Adventure 1	G	Abersoft	16K	£9.95
Adventure 1	G	D J Moody	16K	£5.00
Adventure 2	G	D J Moody	16K	£5.00
Adventure 3	G	D J Moody	16K	£5.00
Adventure 4	G	D J Moody	16K	£5.00
Adventure In Time	G	Work Force	16K	£8.00
Airline	G	Cases Computer Simulations	16K	£5.00
Angle	E	AVC Software	16K	£3.00
Aladdin	E	Bryants Software	16K	£1.87
Alien/Outraider	G	Computer Rentals	16K	£3.50
Alien Dropout	G	Silversoft	16K	£3.95
AM-AZON	U	Amersham Software	16K	£8.00
AM-ZXEDIT	U	Amersham Software	16K	£4.00
AM-ZXFILE	U	Amersham Software	16K	£4.00
AM-ZXMON	U	Amersham Software	16K	£6.00
Animated Arithmetic	E	LCL	16K	£6.50
Arithmatic Teasers	E	Hard & Soft	3K	£3.95
Around Europe in 80hrs	G	S Hessel	16K	£4.25
Art & Fun	G	A Parsons	16K	£4.95
Assembler	U	Artic	16K	£6.95
Asset Stripper	G	Buffer	16K	£4.50
Asteroids	G	Quicksilva	16K	£5.50
Asteroids	G	Mikro Gen	16K	£3.95
Asteroids	G	Silversoft	16K	£3.95
Asteroids	G	The Software Farm	16K	£5.95
Astrology	D	Stellar Services	16K	£4.95
Astro Sled	G	Arcadia	16K	£1.99
Astro Invaders	G	John Prince	16K	£3.65
Atoms	E	AVC Software	16K	£3.00
Autochef	D	Cases Computer Simulations	16K	£5.00
Avenger	G	Abacus Electronics	16K	£4.95
Awari	G	Foilkade	16K	£5.95
Awari	G	Understanding	16K	£5.95
Bagatelle	G	Cambell Systems	1K	£4.00
Bank Account	B	Transform	16K	£8.75
Bargain Bytes 1	G	Richard Shepherd	16K	£5.00
Bargain Bytes 2	G	Richard Shepherd	16K	£5.00
Battleships/Kami-Kazi Drive	G	V&H Computer	16K	£3.50
Battle of Britain	G	Buffer	16K	£4.50
Beam Analysis	B	Hilderbay	16K	£25.00
Beamscan	B	Hilderbay	16K	£25.00
Bearings	E	Bryant Software	16K	£1.87
Biology 1	E	AVC Software	16K	£3.00
Biology 2	E	AVC Software	16K	£3.00
Black Crystal	G	Carnell Software	16K	£7.50
Black Star	G	Quicksilva	16K	£4.95
Breakout	G	Anglo American	16K	£4.50
Breakout	G	Bug Byte	1K	£3.50
Breakout	G	New Generation	1K	£1.95
Breakout	G	Mikro Gen	16K	£3.95
Brick-Stop	G	R & R Software	16K	£3.75
Bridge	G	ZX SAS	16K	£6.50
Bomber	G	Mikro Gen	16K	£3.95
Budget & Address Book	D	J Purves	16K	£4.00
Budget Programs (2)	B	Hilderbay	16K	£17.00
Bumper 7	G	Software Masters	1K	£4.95
Business Bank Account	B	Transform	16K	£8.75
Business Model Modeller X	D	Cases Computer Simulations	16K	£8.00
Business Pack	B	Transform	16K	£25.00



Can Of Worms	G	Automata	16K	£5.00
Cassette 1	G	Astro Software	16K	£3.95
Cassette 1	G	Orwin Software	1K	£3.80
Cassette 2	G	Orwin Software	1K	£5.00
Cassette 3	G	Orwin Software	16K	£5.00
Cassette 4	G	Orwin Software	16K	£5.00
Cassette G2	G	Psion	16K	£4.95
Cassette G3	G	Psion	16K	£4.95
Cassette G4	G	Psion	16K	£4.95
Cassette G5	G	Psion	16K	£4.95
Cassette G6	G	Psion	16K	£4.95

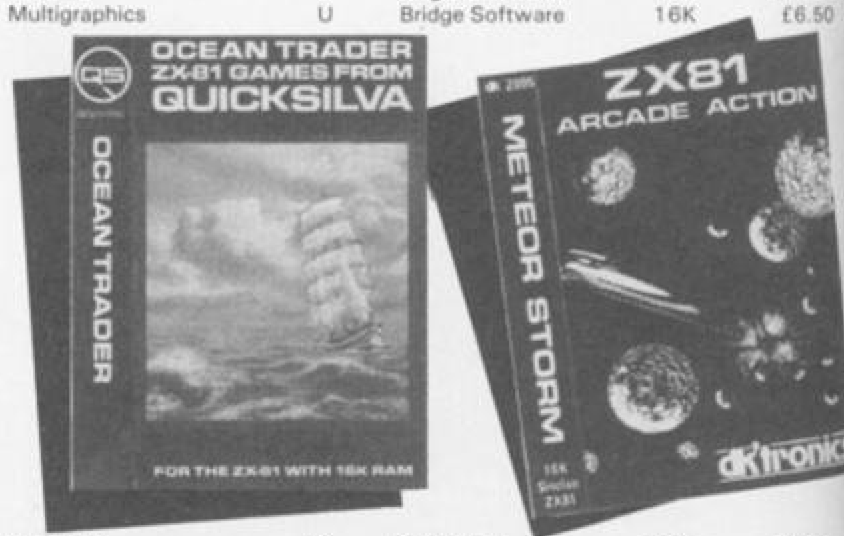


Cassette G7	G	Psion	16K	£4.95
Cassette G8	G	Psion	16K	£4.95
Cassette G9	G	Psion	16K	£6.95
Cassette G10	G	Psion	16K	£5.95
Cassette G11	G	Psion	16K	£6.95
Cassette G12	G	Psion	8K	£4.75
Cassette G13	G	Psion	16K	£3.95
Cassette G14	G	Psion	16K	£5.95
Castle Colditz	G	Felix Software	16K	£4.95
Catacombs	G	J K Greye	16K	£4.95
Catalogue	E	Bryants Software	16K	£1.87
Centipede	G	Llamasoft	16K	£1.95
Centipede	G	dK'tronics	16K	£4.95
Centipede (Graphics)	G	dK'tronics	16K	£4.95
Cesil	E	Gilsoft	16K	£5.95
Champions Quiz	E	Rose Cassettes	16K	£4.50
Character Predictor	D	Hard & Soft	1K	£3.95
Chess	G	Mikro Gen	16K	£6.50
Chess Board	G	Hard & Soft	1K	£3.95
Chess 1.4	G	Abersoft	16K	£8.95
Chess II Special	G	Artic	16K	£45.00
City	G	Macronics	16K	£5.95
City Patrol	G	Sinclair Research	16K	£4.95
Claws	E	Bryants Software	16K	£1.87
Combined Database	B	Anik	16K	£9.95
Comecocos	G	Impact Software	16K	£4.95
Compiler	U	Silversoft	16K	£5.95
Compound	E	AVC Software	16K	£3.00
Compufile	D	Jaysoft	16K	£4.95
Computerwine	D	Computerwine	16K	£7.95
Computer Count ZX	B	Buffer	16K	£7.95
Condition Red	G	Work Force	16K	£3.95
Conflict	G	Martech Games	16K	£9.50
Constellation	G	Anglo American	16K	£8.00
Cosmic Guerilla	G	Quicksilva	16K	£3.95
Counter	G	Buffer	16K	£5.50
Counter Attack	G	Woodside Software	16K	£4.95
Crag of Doom	G	Micromor	16K	£4.99
Crash Boot	G	Impact Software	16K	£4.95
Critical Path Analysis	B	Hilderbay	16K	£15.00
Croaka Crawla	G	Quicksilva	16K	£3.95
Crystal Ball	D	Hard & Soft	1K	£3.95
Cursor Input	U	Serious Software	1K	£2.95
DCoder	U	Personal Software Services	16K	£5.95
Dallas	G	Cases Computer Simulations	16K	£5.00
Damper/Glooper	G	Quicksilva	16K	£4.95
Damsel & the Beast	G	Anglo American	16K	£6.50
Damsel & the Beast	G	Bug Byte	16K	£6.50
Danger Track	G	Impact Software	16K	£4.95
Database	B	Gemini	16K	£7.50
Database	B	Database Systems	16K	£4.95
Data Base	B	J Purves	16K	£10.00
Data Base	U	Cambell Systems	16K	£10.00
Data File	B	Matrix Software	16K	£4.95
Data File	B	MP Software	16K	£7.50
Data File/ Graphics	U	V&H Computer	16K	£2.50
Death Isle	G	Buffer	16K	£4.50
Death Star Attack	G	Palantir	16K	£5.00
Debug	U	Mikro Gen	16K	£3.95
Defender	G	Quicksilva	16K	£5.50
Deflex	G	dK'tronics	16K	£3.95
Dictator	G	Anglo American	16K	£9.00
Dictator	G	Bug Byte	16K	£9.00
Diggles Kitchen	D	Micro Computer	16K	£4.99
Diggles Kitchen Vol 1	D	Micro Computer	16K	£4.99
Diggles Kitchen Vol 2	D	Micro Computer	16K	£4.99
Diggles Kitchen Vol 3	D	Micro Computer	16K	£4.99
Diggle's Wine Cellar	D	Micro Computer	16K	£4.99
Do Not Pass Go	G	Work Force	16K	£6.95
Double Breakout	G	Buffer	1K	£6.00
Draft	U	Myrmidon Software	16K	£7.50
Dragon Maze/Life	G	Software Masters	16K	£6.95
Educational Quiz	E	Rose Cassettes	16K	£4.50
Eights	G	Hardy Software	16K	£4.00
Electricity	E	AVC Software	16K	£3.00
Electronics	E	Spectre	16K	£5.95
Encounter	G	Pixel	16K	£5.50
Ephemeris	U	Bridge Software	16K	£6.90
Espionage Island	G	Artic	16K	£5.95
Fantastic Voyage	G	Foilkade	16K	£5.95
Farmer	G	Cases Computer Simulations	16K	£5.00
Fast Life	G	dK'tronics	16K	£3.95
Fast SAVE/LOAD	U	Musamy Software	16/64K	£6.00
Fawkesoft Tape 1	G	Fawkes Computing	16K	£4.95
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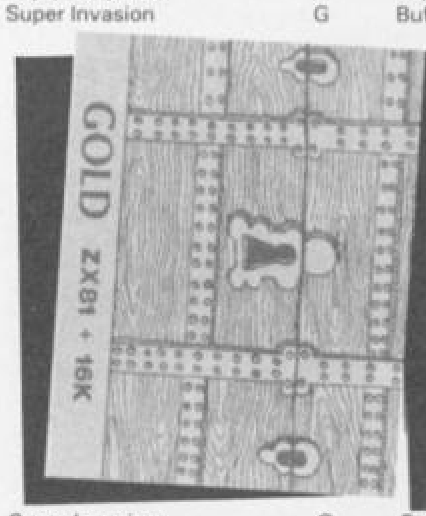
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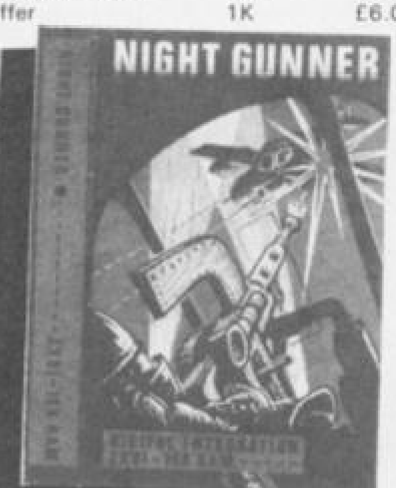
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MACHINE SPECIFICATIONS

ZX80

Dimensions
Width 174mm (6.85 in)
Depth 218mm (8.58 in)
Height 38 mm (1. 5 in)
Weight 300g (10.5oz)

Microprocessor/Memory
Z80A 3.25 MHz clock
ROM: 4K bytes containing BASIC
RAM: 1K bytes internal, externally expandable to 16K bytes.

Display
Requires an ordinary domestic black and white colour TV. The lead supplied connects between the ZX80 and your TV's aerial socket. The display organisation is 24 lines of 32 characters per line showing black characters on a white screen. The ZX80 does not connect to a printer.

Programming
Programs can be entered on the keyboard or loaded from cassette. The ZX80 has automatic "wrap round" so lines of program can be any length but not multi-statement lines.

Syntax check
The syntax of the entered line is checked character by character. A syntax error cursor marks the first place the syntax breaks down if there is an error. Once any errors have been edited out the syntax error cursor disappears. Only syntax error-free lines of code are accepted by the ZX80.

Graphics
Total of 22 graphics symbols giving 48 x 64 pixels resolution consisting of 10 symbols plus space and inverses. Includes symbols for drawing bar charts. Under control of your BASIC program any character can be printed in reverse field.

Editing
The line edit allows you to edit any line of program or input including statement numbers. The edit and cursor control keys are EDIT, RUBOUT, HOME.

Arithmetic
Arithmetic operators +,–,x, ÷ exponentiate. Relational operators <, >, = , yielding 0 or – 1. Logical operators AND OR NOT yielding boolean result. Relational operators also apply to strings. ZX80 BASIC uses 16 bit two's complement arithmetic (± 32767).

Variables
Numeric variable names may be any length, must begin with a letter and consist of alphanumerics. Every character in the name is compared thus an infinity of unique names is available.

String variables may be assigned to or from, shortened but not concatenated. String variable names are A$ – Z$. Strings do not require a dimension statement and can be any length.

Arrays have a maximum dimension of 255 (256 elements) each. Array names consist of a single letter A–Z.
Control variable names in FOR. . . NEXT loops consist of a single letter A–Z.

Expression evaluator
The full expression evaluator is called whenever a constant or variable is encountered during program execution. This allows you to use expressions in place of constants especially useful in GOTOs, GOSUBs, FOR. . . NEXT etc.

Immediate mode
The ZX80 will function in the "calculator mode" by immediately executing a statement if it is not preceded with a line number.

Cassette interface
Works with most domestic cassette recorders. The transfer rate is 250 baud using a unique tape-recording format. Other systems are not compatible with the ZX80's. The ZX80 also SAVEs the variables as well as the program on cassette. Therefore you can save the data for updating next time the program is executed. The ZX80 does not support separate data files. The lead supplied with the ZX80 is fitted with 3.5mm jack plugs.

Expansion bus
At the rear has 8 data, 16 address, 13 control lines from the processor and Ov, 5v, 9-11v, Ø and internal memory control line. These signals enable you to interface the ZX80 to your own electronics, PIO, CTC, SIO if you want I/O ports etc.

Power supply
The ZX80 requires approximately 400mA from 7–11v DC. It has its own internal 5v regulator.

TV standard
The ZX80 is designed to work with UHF TVs (channel 36)and is the version required for use in the United Kingdom. The ZX80 USA is designed to work with a VHF TV(American channel 2. European channel 3) and is the version required for the American TV system, also for countries without UHF.

ZX81

Dimensions
Width 167mm (6.32 in)
Depth 175mm (6.80 in)
Height 40 mm (1.57 in)
Weight 350 gms (12.15 oz)

Microprocessor/Memory
Z80A 3.25 MHz clock
ROM: Containing 8K BASIC interpreter
RAM: 1K bytes internal, externally expandable to 16K bytes.

Keyboard
40 key touch-sensitive membrane. Using function mode and single press key-word system, this gives the equivalent of 91 keys and also graphics mode allows an additional 20 graphical and 54 inverse video characters to be entered directly.

Display
Requires an ordinary domestic black and white or colour TV. The aerial lead supplied connects the ZX81 to the TV aerial socket. The display is organised as 24 lines of 32 characters with black characters on a white background.

Two mode speeds
The ZX81 can operate in two software-selectable modes - FAST and NORMAL. FAST is ideal for really high-speed computing. In NORMAL mode however the ZX81 allows continuously moving, flicker-free animated displays.

Printer
The 8K ROM will permit instructions (LPRINT, LLIST and COPY) to drive the Sinclair ZX Printer.

Programming
Programs can be entered via the keyboard or loaded from cassette. Programs and data can be saved onto cassette so that they

are not lost when the ZX81 is turned off.
Syntax check
The syntax of a line of program is checked on entry. A syntax error cursor marks the first place the syntax breaks down if there is an error. The syntax error cursor disappears when errors have been corrected. Only lines free from syntax errors will be entered into the program.
Graphics
Apart from the 20 graphics characters, space and its inverse, the display may also be divided into 64 x 44 pixels, each of which may be 'blacked' in or 'whited' out under program control.
Editing
A line editor allows you to edit any line of program or input, including program line numbers. Lines may be deleted, increased or decreased in size.
Arithmetic
Arithmetic operators +, –, x, ÷, exponentiate. Relational operators =, < >, >, <, < =, > =, may compare string and arithmetic variables to yeild 0 (False) or 1(True). Logical operators AND, OR, NOT yield boolean results.
Floating-point numbers
Numbers are stored in 5 bytes in floating-point binary form giving a range of $\pm 3 \times 10^{-39}$ to $\pm 7 \times 10^{38}$ accurate to 9½ decimal digits.
Scientific functions
Natural logs/antilogs; SIN, COS, TAN and their inverses;SQR; e^x.
Variables

Numerical:	any letter followed by alphanumerics
String:	A$ to Z$
FOR-NEXT loops:	A–Z (loops may be nested to any depth.
Numerical arrays:	A–Z
String arrays:	A$ to Z$

Arrays
Arrays may be multi-dimensional with subscripts starting at 1.

Expression evaluator
The full expression evaluator is called whenever an expression, constant or variable is encountered during program execution. This powerful feature allows use of expressions in place of constants and is especially useful in GOTO, GOSUB etc.
Command mode
The ZX81 will execute statements immediately, enabling it to perform like a calculator.
Cassette interface
Works using domestic cassette recorders. The transfer rate is 250 baud and uses a unique recording format not compatible with other systems. The ZX81 will save the data as well as the program to avoid the need to re-enter the data when the program is next loaded.,
ZX81 will search through a tape for the required program). The cassette leads supplied have 3.5 mm jack plugs.
Expansion port
At the rear, this has the full data, address and control buses from the Z80A CPU as well as OV, +5V, +9V,Ø and the memory select lines. These signals enable you to interface the ZX81 to the Sinclair 16K RAM pack and ZX printer.
Power supply
The ZX81 requires approximately 420mA at 7–11V DC. It has its own internal 5V regulator. The ready assembled ZX81 comes complete with a power supply. The ZX81 kit does not include a power supply.

TV standard
The ZX81 is designed to work with UHF TVs (channel 36) 625 lines.

ZX SPECTRUM

Dimensions

Width 233 mm
Depth 144 mm
Height 30 mm

CPU/Memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.
16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-key keyboard with upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/speaker.

Graphics

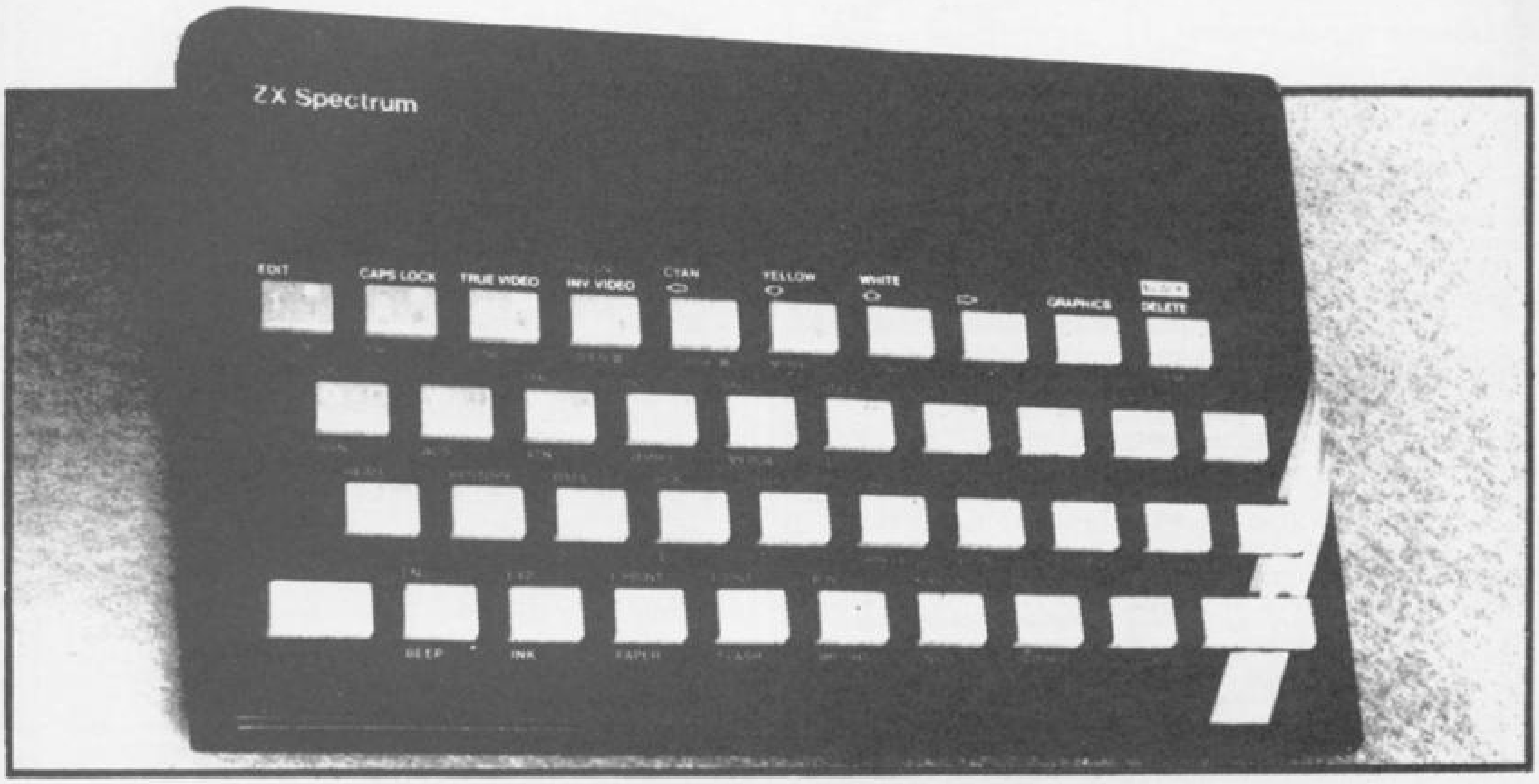
Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive — or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magneta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section — normally the first 22 lines — displays the program listing or the results of program or command execution. The bottom section — normally the last 2 lines — shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.



Mathematical Operations And Functions

Arithmetic operations of +, −, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generation, and pi.
Numbers are stored as five bytes of floating point binary — giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to 9½ decimal digits.
Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).
User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.
There is a full DATA mechanism, using the commands READ, DATA and RESTORE.
A real-time clock is obtainable.

String Operations And Functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code. A string slicing mechanism exists, using the form a$ (x TO y).

Variable Names

Numeric — any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String — A$ to Z$.
FOR-NEXT loops — A-Z.
Numeric arrays — A-Z.
String arrays — A$ to Z$.
Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression Evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.
It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette Interface

A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.
All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.
Programs, blocks of memory and arrays may be verified after saving.
Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.
Programs may be saved with a line number, where execution will start immediately on loading.
The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion Port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives. IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 Compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.
FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.
SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.
UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.
Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

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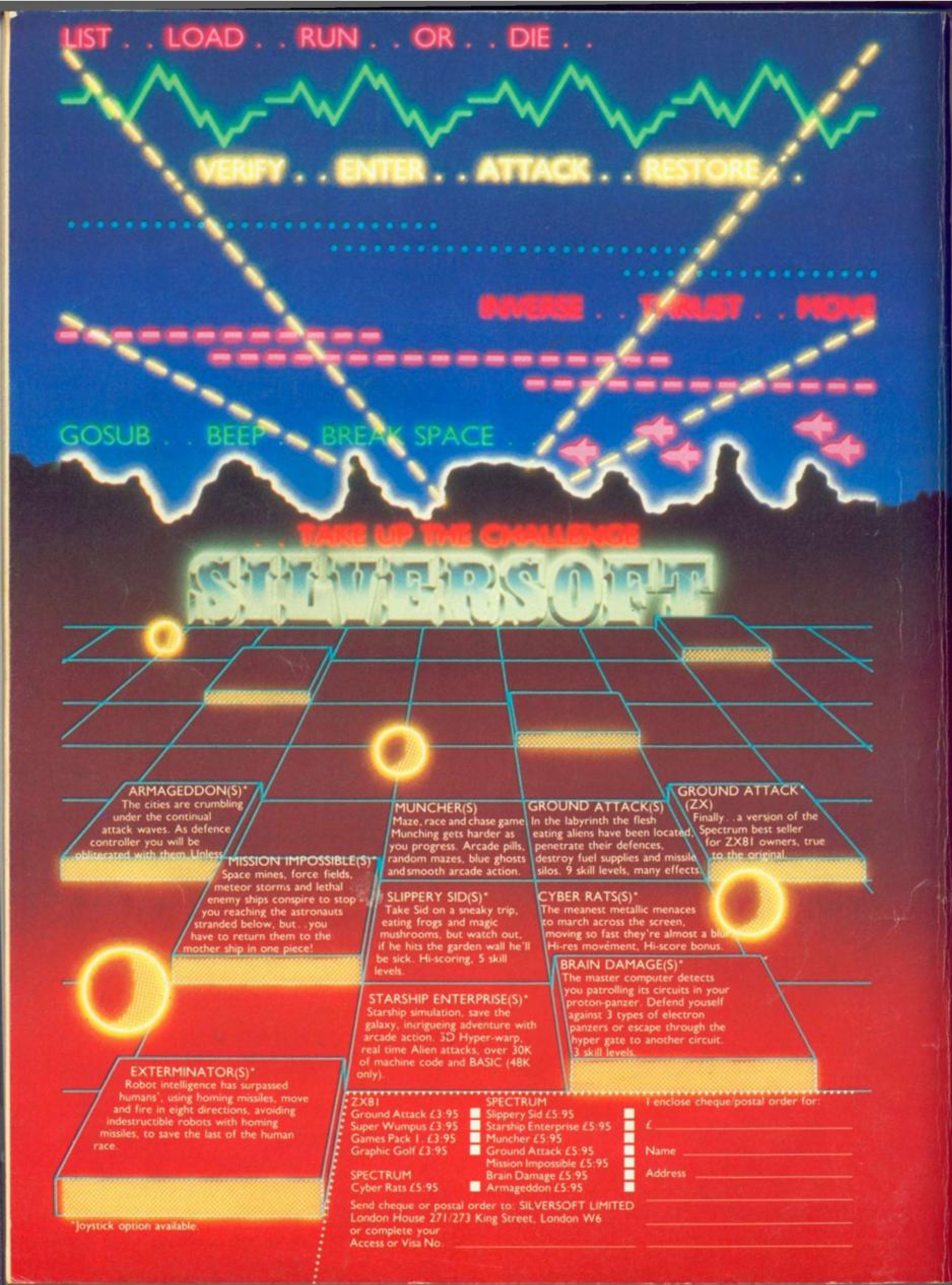
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